THE IRON TRADE REVIEW

VOLUME XXIII. CLEVELAND, O., APRIL 10. 1890. NUMBER 15

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS
IS PUBLISHED EVERY THURSDAY BY THE
CLEVELAND PRINTING AND PUBLISHING CO.,
Corner St. Clair and Wood Streets, Cleveland, O.

TERMS, (strictly in advance):

One year	$3 00
Six months	1 50
Three months	75

Advertising Rates Furnished on Application.

NEW YORK OFFICE: TIMES BUILDING ROOM 109. CHARLES H. WRIGHT, MANAGER.

ENTERED AT THE POSTOFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER

CLEVELAND O., APRIL 10, 1890.

THE WEEK IN IRON CIRCLES.

General Features. The chief topic of interest continues to be the decline in Southern irons. The rapidity of the "slump" has never before been witnessed in Central Western markets. There are many who think this is better for the trade than it would have been had the decline lasted through many months. The situation differs materially from what it was in previous years when equally low figures have ruled. Consumption is now very much heavier, and foreign importations are stopped. General business is promising, the railroads are prosperous, iron is finding its way into many new uses, and there is no prospect of foreign iron coming this way in any quantity for a long time to come. The low prices will slowly curtail production by the blowing out of furnaces, and will delay or kill off most of the new furnace projects. The conditions, therefore, seem healthy and favorable to an early reaction. A good many large buyers are taking this view of it, and are now testing the market. Inquiries in Cincinnati in the aggregate are heavier than at any time since November last. The exceptional prices of a week or two ago are now general, Southern No. 2 selling at $15, No. 3 foundry at $14.50, and grey forge at $14 at Cincinnati. Buyers at Louisville have been so timid for a week past about making purchases, all fearing that their competitors by waiting a few days might secure an advantage, that the leading furnaces have settled matters by putting prices to the lowest notch. This action has been productive of considerable buying. Sales, however, are for prompt deliveries. Chicago is often termed the dumping ground for all the iron districts in the country at a time of low prices. The present situation in that market seems to justify the theory. The quantity of iron offered is not large, but certain prices that have been quoted on Southern irons are only explained on the theory of necessity to realize. Southern No. 2 foundry has been offered at $16 in large deals, and other grades in proportion. Our Detroit correspondents (Wm. F. Jarvis & Co.) write: "The general market can be said to have been pretty well unveiled during the past week, and can hardly be satisfactory to the furnace-men, particularly in the South. A number of large deals for grey forge and low grades of foundry (Southern) irons were made during the past week, and developed a weakness which was not expected, inasmuch as prices showed nearly as low a level as any figures of 1889, at the worst time. It seemed to be a scramble for business at nearly any figure. The general idea seems to be that the large buying in this and other sections of the country will place values at once upon a better plane, but there can be no hesitation in reporting that the market is very weak at the present time. A somewhat noteworthy feature in the general market, is the strength shown in Lake Superior charcoal irons, notwithstanding the general depression in other grades. The market for this grade cannot well be on a much lower basis than existing figures. While many furnaces are sold ahead, the outlook for a larger tonnage business generally was never better than at present. and it is expected that no lowering of prices for this grade of metal will be seen for some time to come. This is largely due to the fact that little, if any, increase has been made in the production, and the consumption for car wheel and malleable use will be considerably larger than in 1890." Pittsburgh, Buffalo and St. Louis report very little change from last advices. Our English correspondents (S. W. Royce & Co, of Birmingham), report a hopeful feeling for the future in pig and manufactured iron.

Iron Ore. No important sales are reported for the week, but the pressing inquiries made by Eastern steel makers for Bessemer ores serve as an indication of the drift of affairs, and add to the strength of the ore market. It is reasonably certain that under favorable conditions another half million tons of Bessemers may be mined for 1890 delivery, and the demand for this class of ores is proportionate to the marketable output in the ratio of 10 to 1. Very little is being done in second-grade ores, of which some considerable amount is not disposed of as yet, but the ore dealers apprehend no sort of difficulty in obtaining November prices, with a chance for a better quotation further along. In reply to the statement made some time ago by certain furnace interests as to the loss, by reason of moisture in working hematite ores, the answer is made that the loss complained of is more than offset by the increased fuel cost in smelting hard ores, and that, while hard ores are undeniably the best for long hauls, the conditions of the local market favor the use of hematites, unless a fancy article is desired for a special purpose. The statement is also made that a furnace working on hematites will turn out more pig iron per day than when smelting hard ores, so that whatever loss may occur, by the consumers of hematite, by reason of getting from two to four per cent. of water in their ores that have been exposed to the water any length of time, is more than made up by the increased drawbacks in the use of hard ores. Vessel charters are very quiet and go without change. Coke remains at $2.15 for the present.

Pig Iron. While it is generally agreed that the worst is over, and that a betterment is about to take place, the market is so unsettled, and various makes of iron of the same grade are selling at such a great range in prices, that it is difficult to find correct quotations. This, however, is a matter that will soon correct itself, as the weaker iron interests are beginning to feel the improvement, and in the same manner as "snap" sales decrease, quotations will reach a uniform basis. The extremely low prices at which Southern irons are quoted have lost their effect in this market, and buyers have so far recovered confidence as in many instances to place round orders, for two and three months' delivery. There are those who have sublime faith in the future, and the forecast was made this week, by an authority in the business, that forge iron would sell at $25 during 1890. At present the price ranges from $15.25 to $16 for that class of iron. Some sales of charcoal iron have been made at $22.50 cash, f. o. b., Cleveland. As the season advances and the old ore stocks begin to run down, many a furnace-man will anxiously compare the cost of production of 1889, with the increased cost of 1890, for the use of new ore means a considerable whittling down of the profit margin. Be that as it may, the volume of sales will not be curtailed. The far-seeing furnace-man knows that buyers don't care the proverbial hill of beans about the cost of production, and will freely sell at the prevailing market rate, whether it be high or low. It is the speculative element, that holds iron when an advance is expected rather than sell with the market, that overreaches itself, and is then compelled to sell at any price to realize. Pig stocks have somewhat increased during March, as was expected from the dropping off of sales; but it is predicted that by September there will not be any reserve stocks of any kind.

Merchant Iron. The market, except for beams and special shapes, is stagnant, and prices are flat. Bar iron is a drug, and kindred material is suffering. Sheets are a little more plenty, and the mills have moderated their demands somewhat.

Scrap Iron. A sale is reported of old American rails at $24.50, and of a round lot of wrought scrap at $21.

Hardware. The Spring season has begun in real earnest with the jobbers, and an enormous business is reported in building material and shelf goods as well as in the machinery line.

PIG IRON AS A BASIS FOR CURRENCY.

Verily, wonders will never cease. Here is that staid and conservative financial journal, the *American Banker*, actually advocating the adoption of pig iron as a basis for a national currency. Is it in earnest or is it simply "taking off" Secretary Windom's silver scheme? Laying down as its major premise, the assertion that "the progression of modern finance, ignoring the theory of metallic circulation, has made money largely the representative of value, not the value itself," it goes on to hold that "coin is now practically obsolete as a medium of exchange" for quick movement, and it insists that "while the custom heretofore has been to use only national bonds, gold and silver for the basis of this currency, yet the intelligence of the most far-sighted financiers and the claims of leading staple values, among them pig iron, are uniting in demanding recognition of these standard commodities of home production as a currency basis just as they are recognized in commercial circles, and in banking transactions as a safe system of credit."

Its reasons for advocating pig iron are two-fold: first, its intrinsic value; secondly, its indestructibility. Its method of putting pig iron currency into circulation is to have warrants issued upon iron deposited by the manufacturer in the "storage yards of the responsible warrant company" (is this the cloven hoof of the entire article?) and a certificate of deposit issued for the same. The owner takes his receipt to his bank to get a loan upon it, assuming the market value at $15 per ton, at tide water, which is about as low a price as it has ever reached; the bank could accept it as collateral for $11.25 per ton, and send the receipt to the Treasury with its guarantee and get the same amount of circulation on it, either then or at any future time. "The Government could not lose," insists the *Banker*, "for it would have prime security in the article itself; and, further, the bank to whom the circulation was issued would be obligated to the Treasury for said issue of notes; in case of any decline in price, the bank would, for its own protection and that of the Government, which would be one, see that its security was kept good. Then, whenever it was desired to redeem the warrants the bank could return the proper amount in circulating notes, re-possess the warrants and re-deliver them to their owner, who would then again have his iron at his disposal."

Such is the scheme, as proposed by our New York contemporary. So wrapped up is it in this truly novel idea, that it even goes to the extent of saying that the security proposed would be superior to Government bonds, for the reason that "governments have often been subverted—conquered—many have passed away." Just wherein the security of a private corporation of Wall street schemers is better, does not appear; and isn't the *Banker* joking, after all?

IRON AND STEEL IN THE WEST.

Mr. O. W. Potter, who has just resigned the chairmanship of the Executive Committee of the Illinois Steel Company, has recently given an interview to the Philadelphia *Record*, of especial interest to Western iron and steel manufacturers. Mr. Potter, as every one knows, is well prepared to speak with intelligence on the subject of iron and steel manufacture in the West, having been at the head of the North Chicago Rolling Mill Company (the immediate predecessor of the Illinois Steel Company) since 1857. In discussing the present condition of the steel industry of the West, Mr. Potter said:

Although the building of new railroads does not promise to be unusually extensive this year, the indications point to a very good year for steel rails, for which there is a heavy demand for renewals and extra tracks. The first steel rails were laid about ten years ago, and their renewal has now become a very large factor in the demand for rails. The railroads of the country will require about 1,000,000 tons annually for this purpose alone. Then the railroads here and in the West are laying second, third and fourth tracks, and even fifth and sixth tracks in some instances. All of this work creates a good market for steel rails. Our nineteen furnaces at our four works are making 3,000 tons of metal daily, and we mean to use all of it. If you should tell us that you wanted 800,000 tons of steel rails this year, I guess we could let you have them.

Concerning the advantages of Chicago as a steel-making center, Mr. Potter said:

As a center for the steel rail industry, Chicago enjoys a considerable advantage in the cheapness with which iron ore can be brought across the lakes from the mines to the furnaces. This is offset, in a measure, by the higher cost of our fuel, for which we have to come to Connellsville; but, as we now have our own coke-ovens and mines in the Connellsville region, and our own transportation to Chicago, we expect to save a little in this item. There is a large market in the West and Northwest that naturally belongs to Chicago, and we expect that we shall be fully able to take care of it. We cannot go into the Southwest, for there we meet Pennsylvania men in the market that is properly theirs.

The enormously increased use of steel and iron for building purposes has given a great impetus to this branch of industry in the West, the Chicago works alone promising to make from 30,000 to 40,000 tons of structural shapes this year. Another new Chicago industry is the building of steel ships (Cleveland capital being mainly embarked in this enterprise). At the North Chicago works is building a basic open-hearth furnace to make steel plates for these ships. The manufacture of tinned plate is also one of the branches soon to be added to the various enterprises of the great Chicago plant.

As to the future, Mr. Potter says:

The tendency of the entire iron and steel industries and all their branches is toward a larger volume of business at a smaller margin of profit, and I believe there will be a continual cheapening of products. The concern that made 50,000 tons of steel a few years ago is now able to make 100,000 tons at a smaller proportionate cost per ton. The railroad that hauled 500,000 tons of ore last year can haul 1,000,000, tons this year with about the same fixed charges, and, consequently, at a lower rate per ton. A few years ago the largest ore steamers we had on the lakes were of 750 tons capacity. We now have steamers that will bring 3,100 tons of ore from Escanaba to our Chicago furnaces at no greater cost than the transportation of the 750 tons a few years ago, and I expect that a few years hence we shall be able to take 5,000 tons of ore at the present cost of carrying 3,100 tons.

We rejoice in Chicago's prosperity, and have only to add one word: Cleveland has the same elements at work in building up a great steel center and will not be far behind her Western sister in the race for industrial supremacy.

SENSIBLE ADVICE BY A WELL-KNOWN IRONMASTER.

In answering the question "What would be your advice to Southern iron-masters in reference to their product," propounded by the Chattanooga *Tradesman*, Mr. Edmund C. Pechin, now of Roanoke, Va., formerly connected with *The Iron Trade Review*, and pronounced by the Chattanooga paper "one of the best-posted iron men in America," gives the following excellent piece of advice:

In the first place, don't put another cent, for possibly years to come, in new blast furnaces. Put every cent "you can beg, borrow or steal" in industrial plants to work up into finished forms the iron you already make. You are deliberately, persistently and rapidly depleting your mines, and, for comparatively a mere pittance of profit, sending your raw materials to other sections to produce the wealth that you ought to keep at home. A furnace makes nothing, except for a mere song, exhausting gradually it may be, but surely, your natural resources. Mills and factories mean a home market and full paid labor and profitable stores, and a prosperous community generally. $250,000 to $300,000, the cost of a modern furnace plant, means simply a hamlet of low priced labor and commissary; the same capital invested in classified industries, means a busy hive of skilled, high priced citizens, with their families to be well educated, well clothed and well fed. It means churches and schools, and prosperous merchants and a long and steady step forward towards progress and civilization.

Mr. Pechin is right, beyond question, and the present drop in Southern irons is in striking confirmation of his views, so forcibly put forth.

A FAR-REACHING PATENT DECISION.

A decision of considerable importance was announced by the Supreme Court of the United States in the case of Pohl *versus* The Anchor Brewing Company, and it concerns many patent cases now pending. The text is not yet printed, but the announcement is full enough to show that the Supreme Court has overruled the decision of the Circuit Court of the Southern district of New York, in deciding that United States patents, issued for inventions which have been previously patented abroad, do not terminate when the foreign patents may happen to come to an end, as a penalty of non-payment of taxes, importation in contravention to foreign laws, or other breaches of conditions subsequent, on which those patents are issued.

The case is one upon a patent for the washing of beer barrels, but the decision will be far-reaching, and affect a large number of interests. The Westinghouse and Edison companies have been in litigation for some time on questions involving the one decided in this case, and it was used in argument by their counsel.

This seems to leave it clear that American patents can not be injured on account of foreign patents, except so far as to be limited to the term for which the foreign patent issues.

WAGES OF CANADIAN MINERS.

We have received from Mr. T. D. Ledyard, of Toronto, a letter enclosing a communication which he recently sent to the Toronto *Globe*, in answer to the *Canadian Manufacturer*, regarding the wages of Canadian iron miners. In commenting upon this communication, Mr. Ledyard says that it will "serve as an answer to the assertion of the *Engineering and Mining Journal* in stating that the wages of iron miners in Canada were higher than those of American miners, when, as a matter of fact, they are much less." We fail, however, to see that Mr. Ledyard makes his point in the communication in question.

While it is doubtless true that mining has been done in Canada at the low cost of $1 per ton, even Mr. Ledyard will have to admit that, with the conditions of Lake Superior mines paralleled in Canada, the above rate could not be maintained a single day. It is very easy to figure low costs when a mine is first opened up; the real business of mining commences, however, after the operations have been carried to an extent that calls for expensive plants of air compressors, pumping machinery, hoisting appliances, etc., and where the work is mainly far underground. We cannot believe that Mr. Ledyard is not informed as to these points of difference, yet we do not recall a single instance, in any of his newspaper letters, where he has taken up and candidly considered this essential feature of the case. If the argument for reciprocity rests upon no stronger argumentative foundation than this, it does not appear to be worthy of serious consideration.

A NORTHERN EXPOSITION OF SOUTHERN INDUSTRIES.

Here is the boldest and best scheme yet set on foot by the progressive Southern manufacturers: It is nothing less than the project to hold, in 1891, in some one of the great Northern cities, an Exposition of Southern Industries. In the language of one of the projectors, the Southern people propose "making a Northern pilgrimage, bringing the products of the soil, mines, factories and forests, to show what is being done in the Southern States." This will be an invasion very unlike the one which pushed northward as far as Gettysburg twenty-five years ago; on the other hand, so far from being unwelcome, the invaders will be cordially received, and we do not know of a Northern city that would not be glad to make a place for the projected building. That the enterprise will be pushed through to successful completion is promised in view of the fact that prominent and influential Southern men are behind it.

THE MAGNITUDE OF OUR LAKE COMMERCE.

The first issue of the Inland Lloyds Register, under direction of Capt. McLeod, is in the hands of the insurance agents. The *Marine Review* has prepared from the register some very interesting figures regarding the wonderful increase of floating property on the lakes, and presents them in connection with the data regarding the work of the lake ship yards during the past four years. Government officials, members of Congress and representatives of Atlantic coast interests express surprise of late when informed of the magnitude of the lake commerce, and wonder at the statement that more tonnage passes the city of Detroit during the season of navigation than any other point on the globe. These figures may tend to overcome any doubt in that regard and will also prove interesting to vessel owners and shippers who have hardly stopped to consider the entire increase in new tonnage during the past few years of active work in the ship-yards.

As shown in the following table, the new book contains a rating, valuation, etc., on 1,974 crafts, the aggregate value of which is $50,200,800, and the net tonnage, custom house measurement, 764,572. This summary does not include any of the large number of small coasting sail vessels or low grade lumber carriers, but in cases where a valuation is not given in Lloyds, a fair estimate has been made. The Lloyds valuation is probably ten per cent. higher than actual valuation. This is offset, however, in the low grade tonnage not included in the book, and the following summary, including boats under contract at the ship-yards, is a good representation of the merchant marine of the lakes:

Class	Number of boats	Net tons	Valuation
Sidewheel	41	15,994	$ 1,897,000
Steamships	590	436,613	36,438,100
Sail and consort	906	299,608	9,204,750
Tugs	437	12,357	2,660,950
Totals	1,974	764,572	$50,200,800

Canada's merchant vessels, although not included in this summary, would make a noticeable addition to it. The valuation of Canada's floating property cannot be obtained readily.

Sixty-two new steamships and eleven sail vessels represent the new fleet in the register for 1889. These have an estimated valuation of $6,650,000, and aggregate 70,000 tons.

In connection with this summary from the register, a few figures regarding the work of the ship yards during the last few Winters will suffice to show that the lake fleet has more than doubled itself within that time. The following table shows the number of boats building under contract in December of each of the past four Winters. Unfortunately, their carrying capacity in gross tons is represented instead of registered tonnage, and a few boats were contracted for and built each year after the ship-yards were full in December. The total valuation from the figures at hand, $27,389,000, is sufficient to show that more tonnage has been turned out of the ship-yards since the Summer of 1886 than was then afloat. The record is as follows:

Winter of	Number of boats.	Capacity gross tons.	Valuation.
1886-87	31	65,750	$ 4,074,000
1887-88	60	108,525	8,325,000
1888-89	59	100,905	7,124,000
1889-90	56	124,750	7,866,000
Totals	206	399,975	$27,389,000

From present indications, the ship-builders will find cause for repeating the work of past seasons during the coming Fall and Winter, and the question often asked is, when will the reaction occur?—[Marine Review.

IRON CONSUMPTION AND PROTECTION.

Few are aware of the increase in consumption of iron under protection in this country, and fewer still realize how much the protective policy has done to render possible such an increase in consumption. The consumption of pig iron alone has more than doubled within the last ten years, for it was 7,748,817 tons last year, and only 3,409,211 in 1879, but it also nearly doubled in the previous decade, and more than doubled in the decade beginning with 1859, when it was only 827,609 tons. In 1860, the last year of a Democratic revenue tariff, the entire consumption of raw iron, including domestic and imported pig and imported scrap iron and steel, was only 64½ pounds per capita; now, it is 267½ pounds. Then, nearly a tenth of the raw iron was imported, and now, less than a fortieth, or about six pounds per capita.

The total importation of manufactured iron of all kinds was last year only 19¼ pounds per capita, but more than half 11¼ pounds per capita, was in the form of tin plates alone. In 1860, nearly 16 pounds per capita of other imported iron was used, but in 1889, less than 8 pounds. The imports of tin plates have steadily increased, more than 50 per cent. in the last decade and nearly 90 per cent. in the decade preceding. The imports of rails have been very variable, rising to 28½ pounds per capita in 1871, falling to practically nothing in 1877, rising again to 13¼ pounds in 1880, and falling again in 1889 to only a fifth of a pound per capita. In the following statement of consumption per capita, the "imports for consumption" are included for years except the last, but as that official statement is not published for the last calendar year, the imports for that year are used:

	1889.	1879.	1869.	1859.
Consumption, domestic pig	261.49	126.06	102.43	54.61
Consumption, imported pig and scrap	6.20	51.59	19.63	5.88
Consumption, total raw iron	267.60	177.65	122.06	60.49
Consumption, imported rails	.21	4.86	17.28	8.03
Consumption, imported tin plates	11.38	7.58	3.99	2.37
Consumption, imported, other manufactured	7.69	6.56	7.43	14.52
Total consumption	286.89	196.64	150.76	86.29
Per cent. foreign	8.9	37.5	32.1	36.7

To appreciate how improbable it is that consumption could thus have grown, had this country been as dependent upon foreign works as it once was, it is only necessary to remember that the American production has increased 4,900,000 tons in ten years, but the British production, "with all the markets of the world open," as Free Traders are wont to say, has increased but 4,600,000 tons in thirty years. Of that increase, moreover, no less than 330,000 tons were shipped to this country in the form of tin plates, and was therefore caused by failure to put an adequate duty on that product.

Thirty years ago more than a quarter of all the iron and steel consumed in this country was in the form of rails, 21⅔ pounds per capita, and only 64⅔ pounds in all other forms. Now, the consumption of rails has, indeed, more than doubled, having been 50⅔ pounds per capita in the year 1889, and still larger in several previous years, but the consumption of other iron has risen in far greater proportion, amounting to 236¼ pounds per capita in the year 1889. This latter increase has been 85 pounds during the last decade, or nearly 60 per cent.; 50 pounds in the decade preceding, or about 50 per cent., and 37 pounds during the decade ending with 1869, or nearly 60 per cent. It is because the American manufacture has been so encouraged that it is able to furnish beams and bars, plates, tanks, pipes and materials of every kind for buildings and bridges, that the consumption in this country has so greatly increased. Out of the entire increase in consumption per capita during the last thirty years, which has been 200 pounds per capita, about 170 pounds, or nearly seven-eighths, has been neither in rails, domestic or foreign, nor in other forms of manufactured iron and steel imported, but in forms other than rails; much the greater part of it has been in those special forms of iron and steel which are produced either upon specification and orders to meet contracts in this country, or to satisfy the ascertained local demand in other departments of industry.—[New York Tribune.

Higher Boiler Pressures

Since the introduction of triple expansion engines, it has been conclusively proven that high boiler pressures and increased number of expansions is the correct method of obtaining increased economy in the conversion of the heat contained in coal into work. The higher boiler pressures required necessitates increased strength in the boiler, and with the present factor of safety allowed in boiler practice, we find that the circular shell is sufficiently strong, when properly riveted and of the right thickness, but that the flat surfaces are the places that require strengthening. With the usual methods of increasing the strength by braces and stays more or less difficulty has been experienced. Stay-bolts that are screwed into both sheets, and the heads riveted over, frequently give trouble from leaking and occasionally pulling through, or the heads breaking off; while with the stay, that consists of a bolt through the sheets with a nut on each end, and grummets under the nuts, considerable bother is experienced, and as there is more or less uncertainty in tightening them, they are at all times an unreliable factor. The latest method noticed for staying sheets, and that appears sufficient to give the required strenth, and at the same time be free from leakage, is one lately patented by Henry Schaubb, foreman boiler-maker for Messrs. Neapie and Levy. The stay consists of a tube passing through both sheets, and riveted over at the ends in the same manner in which the tubes are riveted in heads of boilers; this serves to prevent leakage. Through these tubes are passed bolts, the heads of which are cut away on the under side sufficient to miss the bead, or that part of the tube which is riveted over. The nuts are cut away in the same manner. This arrangement provides for tight joints and plenty of strength, with no chance for corrosion on account of the kind of water used.—[Stationary Engineer.

On the Clyde they are building the largest sailing vessel. It will have five sails, will be of 9,600 tons and over 350 feet long.

AFFAIRS OF THE OTIS STEEL COMPANY, LIMITED.

Our readers will, we are sure, be much interested in the following full account of the first general meeting of the shareholders of the Otis Steel Co., Limited, held at Winchester House, Old Broad street, London, on Wednesday, March 26, Mr. J. T. Smith (the chairman of the company) presiding. We are indebted for this report to the London *Iron and Steel Trades Journal*, of March 29, just at hand:

The Secretary (Mr. A. G. Pollock) read the notice calling the meeting.

The Chairman: Gentlemen, I beg to move "That the balance-sheet and statement of accounts be adopted," and I believe that you will consider the report as read. I would just like to take you through certain items in the profit and loss account and balance-sheet. As this is the first year that we have had a statement to submit, we have had it made in a form which we trust will be approved, and which will be continued in the future. We have no figures of our own to enable you to compare this year's operations with those of previous years. At the same time, there were certain statements in the prospectus, and I want to make those statements harmonize as much as possible with this account, which we have now put before you. The item of capital expenditure on freehold land, buildings, good will, etc., amounting to £422,783 ($2,054,725) is made up of: value of land, £100,760; buildings, £66,147, and good will, etc., £255,876. The plant and machinery stand at £223,294, which forms part of Messrs. Higson's valuation of £390,000 2s. 1d. We have stocks of material, stores, etc., £109,982 4s. 5d.; but in the valuation of Messrs. Higson, the loose tools and spare machinery were put at £26,313. We have divided that, and have only charged £13,340 upon that head, leaving a balance of over £13,000 to go into the stocks of materials, as above. We have sundry debtors in London and America amounting to £111,717 6s.; we have bills, receivable, £37,313 19s. 9d.; then there are investments, £21,739 2s. 7d.; cash in London, £20,873 8s. 6d., and in America, £23,666 9s. 10 d., making a total of £44,539 18s. 4d. of cash. The total assets are £986,925 3s. 1d. (say, $4,786,455). On the other side of the account, you will find the share capital amounting to £600,000; 6 per cent. debentures, £300,000; sundry credit balances, £48,278 13s. 2d. Then there is debenture interest accrued and payable on January 1st, 1890, £3,832 15s. 3d.; dividend on 8 per cent. cumulative preference shares, payable on January 1st, 1890, £5,009 10s. 6d., and the proposed dividend we shall ask you to sanction to-day, at the rate of 15 per cent. per annum, which will require £13,068 10s. 4d. (say, $63,510.) We have next a reserve fund of £15,000, and we carry forward £1,735 13s. 10d. to next year. Now, roughly speaking, in looking at the profit and loss account, you will find that, on the working, we have a net balance of £87,486 14s. (say, $425,181).

In the prospectus last year it was stated by the accountants that the profits for 1887 and 1888 had been arrived at after taking something over £30,000 in each year for repairs and renewals; but I may tell you that this net profit of £87,486 is after charging repairs and renewals this year with the sum of £32,000. Besides this, we have interest on debentures, £1,752 16s. 7d., making a total net profit of £89,239 10s. 7d. (say $433,701). I need not tell you that the directors would have come before you, with very much more pleasure, if they had been able to add £20,000 more, but I should think there is no one who has invested in American securities in the iron trade there, or in the iron trade in this country, who is not thoroughly aware that the last year was an exceedingly depressed one, especially in the earlier part of the year, in the States. It was a peculiar kind of depression that rather affected our company, because, as you are aware, the iron and steel trades of the States depend very much upon the development of railways; and during the last two years the railway interest in the States has been in a very depressed condition, consequent, probably, on the inflation of 1887. Therefore, the profitable part of the business of this company in the early period of the year was affected with reference to those special articles for which the Otis Co. is so well known. The demand for them was, therefore, very much less than was anticipated: consequently, the steel that was made, instead of being turned into these special articles, had to be rolled into stocks of steel, which came into competition with all the rest of the steel works in the United States. Therefore, we hope you will be satisfied with the results of this year, considering the state of trade prevailing for at least the first four months of the year. After that it began to improve, and was very much better, but unfortunately that improvement has not continued. However, here is a company which, in the face of that condition of trade, has not only been able to hold its own, but to make a net profit fairly got out, with stocks properly valued and undervalued, and having sufficient money to pay a dividend at the rate of 15 per cent. per annum on the ordinary shares, after meeting the fixed charges on the other stocks.

You will find in the report that the transfer of the property took place in July last. I might say that since the transfer of the property we may reasonably suppose that there were a great many adjustments to be made in connection with various parts of the business of this large concern. It is only fair to say, on behalf of our colleagues in the States, that in all our business transactions with them there has been very much the same harmony there would have been had they sat at the Board with us in London, and everything we have reasonably asked, has been reasonably, properly and promptly dealt with. We say it took some time for the directors to get into harness. We are rather sorry that was the case, as we can take so much the less credit for what the concern has done during the year. During the time of the negotiations for these works—and, in fact, for some little time before that—it was absolutely necessary, in consequence of the increased trade at the works in certain of the departments, that new expenditure should arise which should greatly increase the value and capacity of the works. These things were agreed upon before the sale of this property took place, and they commenced that new expenditure absolutely outside this £32,000, which will add materially to the value of the works, and involve from the beginning to the end about £50,000. There was about £30,000 of that spent last year, and we have been able to write that off—as you may see—out of the profits of the concern; therefore the capital account has not increased in consequence of this expenditure. As I have said before, the steel trade was in a very depressed condition in the early part of the year. It very much improved as the Autumn advanced; and when we had the pleasure of meeting you at the last statutory meeting we did not say so, but we thought the prospects of the company were at that time so good that we hoped that this year would have been an exceptional one in the iron and steel trade of the States. Had the prices continued at the figures we obtained for a short time, we should have made such a profit during this year as would have enabled us to put to our reserve fund something of a very substantial character, and allowed us to begin properly and rightly to wipe out the amount we have standing as the good will of this concern. The plant and everything in connection with the works have been kept and are in the most efficient state. It has been the pride of the gentlemen who were the proprietors of the works, during their career as iron and steel makers, to have a representative works, and to be amongst the leading manufacturers in America, not only in respect to their machinery and all their arrangements in their works, but also in the quality of their products.

In consequence of Mr. Otis proposing only to remain in this company for some moderate time, and Mr. Jopling being in a very unfortunate state of health for some time during the year, it was felt desirable that if we could get a gentleman in America, who would be agreeable, to associate himself with our colleagues there—who had influence in the trade and amongst the railway companies, and who was a man of noted position—we should try to get such a man amongst our American shareholders to put on the Board on that side. We were, therefore, fortunate in getting, probably, one of the best-known men in that part of the States in Mr. Eells. We elected him on the Board, and think his connection with this company is a very important element, which will be of great assistance to us, and of considerable benefit to the shareholders. I do not think I need detain you longer, and I will now conclude by moving "That the report and account be adopted."

Mr. C. F. H. Bolckow seconded the resolution, which was put and carried unanimously.

The Chairman: I beg to move: "That a dividend at the rate of 15 per cent. per annum be declared, and payable to-morrow—March 27th."

Mr. R. Wigram seconded the motion, which was put and carried.

The Chairman said that was all the business.

Major Isaacs: I venture to ask the shareholders not to separate to-day without an expression of their feeling of gratitude to the Chairman and Board of Directors for their very able management of this concern during the time it has been a limited liability company. It is exceedingly gratifying to find that the expectations that were held out to us in the prospectus have been realized, and we owe, I believe, a very deep debt of gratitude to our Board of Directors for the care which they have taken of our interests from the time they have been placed at the head of our affairs. It is gratifying that you were able at this your first meeting to declare so solid a dividend as you have done, after what you have done with the view of reducing the capital account, and what you have put to reserve. I think our thanks are eminently due to the directors, and I trust the meeting will accord them.

Mr. Lewis seconded the resolution, which was carried *nem. con.*

The Chairman briefly replied, and the proceedings terminated.

Effect of Stress in Steel.

In a paper on the behavior of steel under mechanical stress, by C. H. Carus-Wilson, read before the Physical Society (British), the following conclusions are reached: The effect of a uniform longitudinal strain on a steel bar is threefold. (1) A strain of the molecules; (2) a strain of the elements; (3) a production of flow by the strain of the elements. The elongation due to flow is the strain usually observed, and this may be either recoverable or irrecoverable. The strain of an element is made up of a uniform dilation and a uniform shear about an axis parallel to that of the bar, and, therefore, the flow elongation consists of an increase of volume, together with a certain amount of sliding. The author summed up as follows the general conclusions to which his experiments had lead him: (1) Mechanical strain produces an atomic disturbance in a bar, and this disturbance increases regularly with the stress. (2) For small stresses the disturbance is only partly permanent, but as the yield point is approached, it becomes wholly permanent. (3) The magnetic properties of a loaded bar are, in general, different from those of the same bar unloaded, but there is a certain stress, or range of stresses, over which the bar has the same magnetic properties, whether it be loaded or not.

Use of Oil Residuum as Fuel in Russia.

According to the English consul at St. Petersburg, all the steamers on the Caspian Sea and the majority of those on the Volga use the oil residuum as fuel, while factories and railroads begin to substitute it for wood and coal. A special stove construction has facilitated the introduction of this fuel in domestic use. It occupies a small space, is kept in subterranean tanks that are pipe-connected with the spots where the oil is actually used, and in a distance of 2,400 kilometers, in spite of the freight per rail and boat, is 35 per cent cheaper than coal or wood. Eighty-six thousand tons were shipped on the Volga in 1888, to be used in the interior provinces near that river. Wood is, and will for some time continue to be, used as the common fuel in the northern part of the empire, but only there.

A Significant Item.

If every iron manufacturer in New England should sign a petition for free coal it would not alter the fact that during the past week 500,000 tons of domestic coal, at the least calculation, have been bought by New England mills and railroads at prices which leave Nova Scotia coal, free of duty, even, out of competition. The duty on bituminous coal is inoperative, so far as New England is concerned.—[Boston Advertiser.

COMBINATION RIP AND CROSS-CUT SAW.

We illustrate herewith an improved combination rip and cross cut saw, manufactured by the Indiana Machine Works, Fort Wayne, Ind. Wood-workers will find in this machine a very convenient and efficient tool. The frame is cast in one piece, has a wide floor space, is perfectly rigid and self-contained. The swinging arbors are extra heavy and strong, and revolve on a heavy steel shaft; the adjustment is simple, accurate and durable. Either saw can be so adjusted as to cut all its size will admit, or less, so that a groove of any depth may be made. The table is made in two sections, the right being stationary for ripping; it is provided with a very convenient and accurate fence, which may be quickly set to any position from the saw, and inclined to any angle. The fence may be quickly removed if desired. The cross-cutting table carries a cross fence, which may be readily set to an angle of any degree; this table is also adjustable from the saw to admit the use of a dado head. The machine is provided with countershaft, (a part of frame) and one each 14-inch rip and cross-cut saw. Tight and loose pulleys are 10x4, and should make seven hundred revolutions per minute. For price and further particulars, address as above.

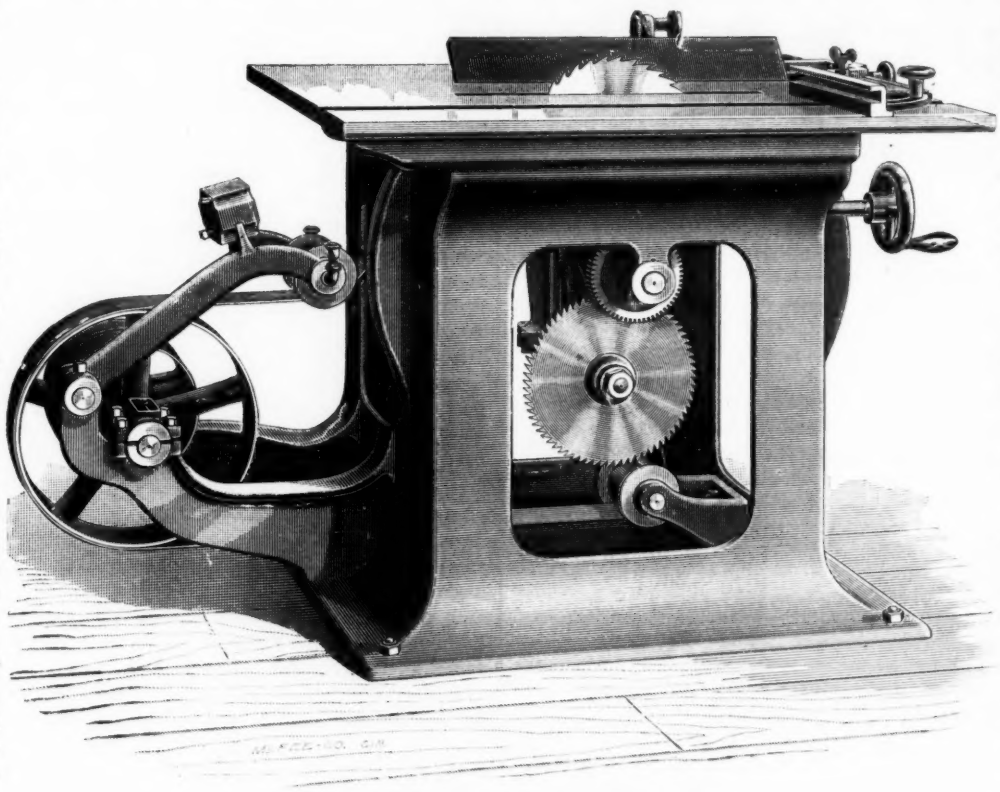
IMPORTANT ORE DISCOVERY.

The Minowan Iron Co., of which A. L. Conger, of Akron, O., is president, and J. R. Van Evera, of this city, the local manager, has made what seems to be a very important iron discovery on its property on the Cascade range. The tract in question is the north half of the southeast quarter of section 28-47-26, and lies about one mile east of the Wheat mine. On the surface the ground is a tamarack swamp, and the ore is overlaid by twenty to forty feet of sand. The ore body as far as located is 1,000 feet in length by about fifty feet in width.

A novel method of exploration was pursued, only possible when the ground is of the nature that it is. A number of iron pipes were driven through the sand to the ore. About fifty of these were put down and the course of the vein followed in this way. A test pit has been sunk, and is bottomed entirely in ore. Steps are being taken to equip the mine with machinery when the shafts will be sunk about fifty feet and cross-cuts put in from the bottom. The Negaunee *Iron Herald* says of the discovery:

"The fact that 50 or more pipes were driven and that the bottom of each was filled with a good quantity of hematite ore seems an ample guarantee for the preliminary work of opening a mine. Mr. Van Evera is to be congratulated upon the success of this new method of exploration which has been comparatively inexpensive and thorough in its results. The company have a favorable lease of two forties, the Chicago & Northwestern railroad already running across one of them and have the best of encouragement for the early opening of a profitable mine. The situation, quality of rock, caping, etc., is quite similar to that at the Queen mine in this city.

Mr. Van Evera was up the road at the property yesterday and hence could not be seen for any further details as to the prospect or quality of ore found. Mr. Conger visited the exploration about ten days ago and was then so well satisfied with the prospect that he practically determined to go ahead and develop the mine.—[Marquette (Mich.) Mining Journal.



COMBINATION RIP AND CROSS-CUT SAW.

Water Gas for Steel Melting.

The British Water Gas Syndicate, Limited, invited a number of steel manufacturers to witness experiments in steel melting by water gas conducted at the Leeds forge, on Friday, last week. The objects of the experiments were to prove the economy of time and fuel in melting an ordinary charge of pig iron into Siemens steel by means of water gas mixed with producer gas, as against the older practice of using merely producer or Siemens gas. It was stated that, under the old system, the Leeds forge had only been able by one furnace to produce from 9 to 11 charges per week, with a consumption of fuel of about 10 cwt. to the ton of ingots produced. Experiments have been going on for some time, and on Thursday work was conducted at a speed of from 20 to 22 charges per week, with a consumption of less than 5 cwt. of fuel per ton of ingots produced, and similar or even better results were expected from the experiments on Friday. Similar apparatus to that employed here is being made for several firms in different parts of the country. The system is said to have been adopted with success on the Continent. For instance, the Herdo Steel Works Co., in Westphalia, are converting all their steel by means of water gas, and are also heating large armor plates with it, and puddling iron in six puddling furnaces. They are also said to be melting pot steel in large furnaces, where 48 crucibles of steel are operated upon with water gas at the same time. The largely increased output of puddling iron may be gathered from the fact that at Herdo, where water gas is used almost exclusively, the quantity turned out per man per shift is 40 cwt. Besides, the product is said to be superior, owing to the high melting point at which water gas does its work. The British Water Gas Syndicate have contracts on hand for the conversion of two large puddling plants for puddling iron by water gas.—[London Iron and Steel Trades Journal.

The Molecular Stability of Iron and Steel.

In an article on the "Molecular Stability of Metals, particularly Iron and Steel," Mr. Carl Barus, of the United States Geological Survey, writes to *Nature*, giving references to the writings of a great many authors, and to Dr. Roberts-Austen and to Dr. W. Anderson, at the New Castle meeting of the British Association. "Neither of these gentlemen," he says, "really shows forth the gist of the matter. Indeed, even in Oswald's massive *Lehrbuch der Allgemeinen Chemie*, Leipzic, full of examples, as it is, bearing on all points of chemical physics, the frequent and exceptionally important case of tempered steel is altogether absent. And yet the chemical interpretation to be given to the phenomena of temper seems to be closely at hand. Dr. Strouhal and I—*Weid Ann.*, xi., p. 390, 1880; 'Bulletin United States Geological Survey,' No. 14, chap. ii., 1885—showed that by the process of hardening the electrical resistance of steel may be increased by more than three times its value for the soft metal. If the hard rod is now softened, the resistance again decreases by an amount depending on the temperature to which the hard metal is exposed and on the time of such exposure, in a way which throughout the whole research, is beautifully sharp and characteristic. Eventually, the relatively low resistance of soft steel is again reached. Now suppose the carbon molecule of steel to be dissolved in the metal, forming an alloy of Matthiessen's Class II. Seeing that the quantity of carbon contained is not large, the electrical resistance of hard steel is at once an expression of its chemical composition, structurally unknown though it be. Hence in the electrical diagram of the phenomena of temper constructed by Dr. Strouhal and myself, the time variations of resistance of hard steel at any given temperature may be interpreted as a case of Wilhelmy's—*Pogg. Ann.*, lxxxi., pp. 413, 409, 1850—rate of chemical reaction—*Reactions-geschwindigkeit*—and expressed in accordance with his well-known exponental law."

Tinning Hard Steel.

In the *English Mechanic*, F. H. Wendham describes, as follows, the method of tinning hard steel, etc.: "In the first place, a bath of melted tin will not injure the temper or materially soften hardened steel surfaces, inasmuch as tin melts at 442 degrees, and polished steel acquires straw color at 460 degrees F. The iron or steel article must first be freed from scale (if any), either from the foundry or forge, by means of a pickle or dilute sulphuric acid, and the scratch-brush or sand. If the articles are of steel, and have been quenched or hardened in oil, every trace of this must be removed by immersion in a boiling soda lye; next, the surface must be made chemically clean; even the film of oxide, due to a pale straw color, will prevent due adherence of the tin to the steel. Have a bath, consisting of one part of hydrochloric acid to about twenty parts of water; hold the article with a pair of brazing tongs, and stir it for a few seconds in the bath; withdraw it, and, while still wet, instantly immerse it in a ladleful of melted tin, the surface of which should be kept from oxidizing by a flush of good, clean tallow. In less than half a minute, the article, when withdrawn, will be found completely tinned. Of course, precaution should be taken not to overheat the tin, but keep it down to the proper melting temperature."

A Worthy Example.

A Montreal brass founder, M. Chanteloup by name, recently deceased left nearly the whole of his fortune of $500,000 to his employes. Each of his 500 workmen get $400 and the three foremen are left the business and sufficient capital to continue its operation. This case is so strikingly exceptional and so well worthy of imitation that we deem it worthy of a special note. It is an act typical of the most practical as well as exalted humanitarianism. —[American Artisan.

EVERY firm in all the leading iron and steel mills in the Pittsburgh district is getting more and more behind with work every day, for the reason that new contracts are being made right along before the orders that were taken months ago are filled. The general complaint is a scarcity of material. —[National Labor Tribune.

THE SOLANO HIGH SPEED ENGINE.

The Solano high speed steam engine has been designed with a view of furnishing means for a most economical and even distribution of effective power, with less cost than has hitherto been accomplished with the ordinary class of reciprocating engines. It is a well-known fact that in large factories, where they employ a large engine at a slow speed, they necessarily are obliged to do what is known as "gearing up," *i. e.*, driving machinery at ordinary speed or fast, requiring shafts, counter-shafts, hangers, innumerable pulleys and belts, costing in time a great deal more than the original outlay for the engine. All these appliances are not only an additional first cost, but also

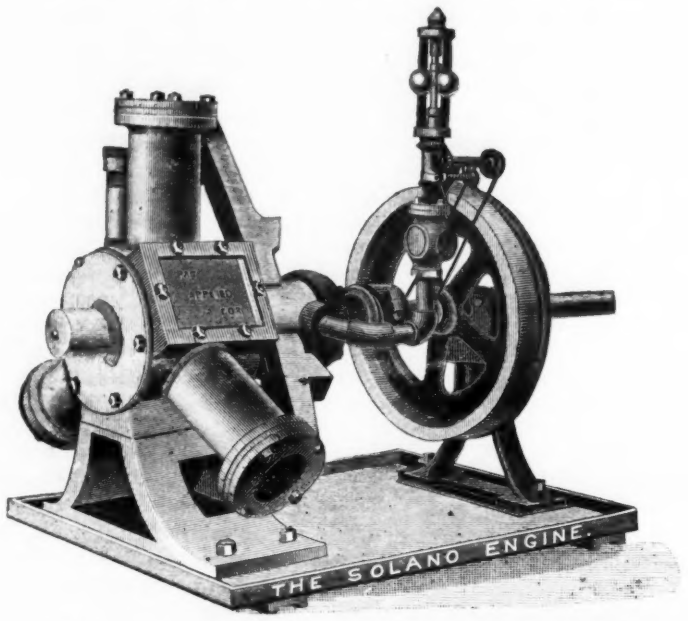


FIG. 1.—THE SOLANO STEAM ENGINE ON STANDARD.

require extra expense for maintenance. It costs to lubricate each additional bearing; it costs the fuel necessary to drive so much useless, expensive and non-producing machinery, which is run solely for the purpose of acquiring the requisite speed that special manufacturing machinery needs; it costs labor to take care of this extra machinery. The cost is necessary simply because the engine must run constant whether the producing machinery is in operation or not, thus consuming a great deal of non-productive power. If manufacturers would indicate their engines when none of the producing machinery is in operation, they would find that it takes from 30 to 60 per cent. of the effective power to run this extra useless machinery.

The manufacturers of the Solano engine (Messrs. Howard & Morse, No. 45 Fulton street, New York) propose to remedy these evils by having the power so distributed that it shall be working only and directly on the producing machinery, and only when it is in operation, by having the Solano high speed engine attached directly to the driving shaft or to the machine itself, this being possible from the fact that the engine, by its design and construction, can be placed anywhere, in any position. By this method more engines are employed, but the cost of these engines combined will not be found as great as that of the large double-acting engine. Therefore, it would

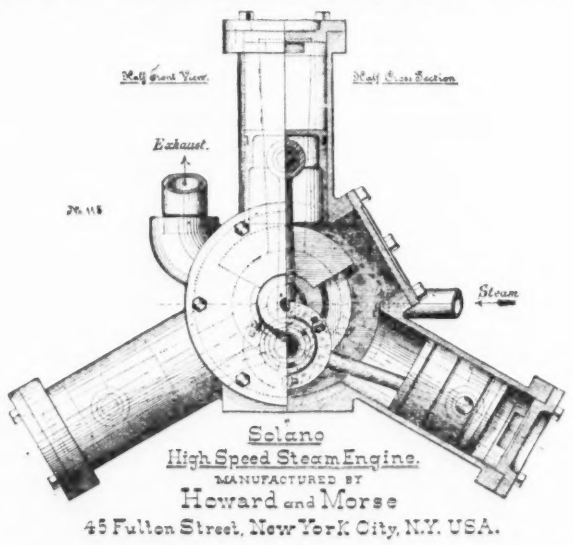


FIG. 2.—SHOWING HALF FRONT VIEW AND HALF CROSS SECTION.

be a gain in first cost as well as being able to utilize the space that the large engine would take.

In presenting the new high speed Solano steam engine to the public, the manufacturers invite special attention to the entirely new design and compact form of its construction. It has so many points of superiority, apparent to any mechanic, that it is necessary to enumerate but a few of the advantages possessed by this valuable improvement. The engine has no dead centre. It can be started with the crank in any position. The working parts being entirely enclosed are protected and kept free from dust and grit. The details of construction are the result of careful and extended experiments; hard study combined with practice. The pistons are deep, light and well packed; guide themselves in the cylinders, and are connected to steel connecting rods, which form the connections to the crank pin. On the end of each rod is a compensating bearing, which, in case of wear, can be readily and cheaply replaced, making the connection as good as new. The valve motion is the most simple ever made, a single rotary valve having steam, steam exhausts and pressure relief parts all combined in one piece. The crank-shaft is perfectly balanced thus insuring long life to the engine. The engine has the most perfect lubri

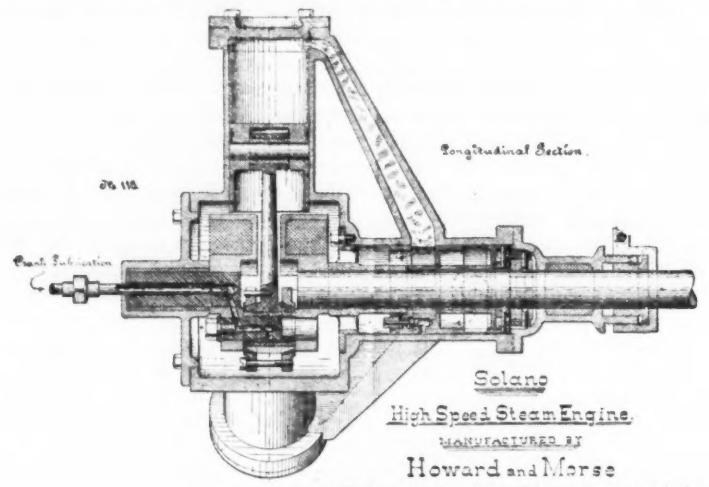


FIG. 3—SHOWING LONGITUDINAL SECTION.

cation, it being entirely automatic. The oil is forced to all the parts that require it. The engine at a speed of 400 or less revolutions per minute requires only the lubricator on the steam pipe. When a greater speed than 400 revolutions is desired, there must be an additional lubrication introduced in the engine direct. The parts of the engine are interchangeable, any piece can be duplicated. There are no stuffing boxes to pack against the steam pressure.

The Largest Corliss Engine Ever Built.

We have received from Messrs. Hick, Hargreaves & Co., engineers, Soho Iron Works, Bolton, England, a photograph of the largest Corliss engine which has ever been built. It is of the vertical type, and stands 48 feet high. It was photographed lying on its side, owing to lack of room vertically to erect it. This engine has been designed to drive directly large dynamos, which are 45 feet in diameter, on the Ferranti system, at Deptford, near London, and which are to supply a current at a pressure of 20,000 volts. The dynamos are not quite ready for the engines, but soon will be. This engine was erected on its side, but the Soho Iron Works are building a large shop which will take such engines in the future. The clear height under the traveling crane will be fifty feet. These engines stand 48 feet high. Mr. William Inglis, engineer of the Soho works, writes: "We are slow folks over here, compared with the United States, which accounts for the long time in building these big dynamos." However, this hardly appears from the character of the work we have just described, because the people who are forwarding this undertaking, which has for it object a direct-driven dynamo, 45 feet in dyameter, and driven by a pair of vertical Corliss engines of 5,000 horse-power each, of which the parts are so large that the bolts for the straps on the connecting rods are nine inches in diameter, can by no means be called "slow folks." In the photograph sent, there appears an ordinary horizontal Corliss engine of 1,000 horse-power, and a comparison between the two shows the enormous dimensions of the 5,000 horse-power machine. These engines, aside from their dimensions, are interesting as being destined to take no small part in a plan which, if successful, will put an entirely new face on the question of the distribution of power over a large area, by means of an electric current of high pressure sent out from a distant generating point. —[Railroad Gazette.

The Enormous Strength of the Forth Bridge.

As showing the immense size and strength of the Forth bridge, in Scotland, a prominent English engineer has made a contrast in the following simple terms: As a grenadier guardsman, put at the average height of 5 feet 10½ inches, is to new-born infant, about 19 34 inches, so is the Forth Bridge to the largest railway bridge yet built in this country. To give an idea of the material used in the construction of the bridge, it may be mentioned that it included about 51,000 tons of steel, of two qualities—one to resist tensile and the other compressive strains, having strengths, respectively, of 30 to 33 and 34 to 37 tons per square inch of tension—and, as we stated before, upwards of 21,000 tons of cement, 707,000 cubic feet of granite, 117,000 feet of masonry and concrete for the foundations and piers, while 1,000,000 cubic feet of timber were used for temporary purposes. As many as 3,800 men were employed at one time in the construction. The stability of the bridge is assured, as far as human foresight can make it, and this will be apparent when it is mentioned that Mr. Baker, one of the engineers for the work, considers that half-a-dozen ironclads could be hung from the cantilever ends. Experts stated that the gale to which the Tay bridge succumbed did not give a higher pressure than 30 lbs. per square foot. In the case of the Forth bridge, a pressure of 56 lbs. per square foot has been allowed for acting over the whole surface—greater than ever has been experienced in this country. As to the cost, it is estimated that £2,250,000 has been spent on the bridge and the north and south railway approaches, but, including the construction of various connecting lines, nearly £3 000,000 (say $15,000,000) will have been consumed.

THE magnetic iron ore beds of Boyertown, Berks county, Pa., have been worked about 125 years.

GARRY'S PATENT IRON AND STEEL ROOFING.

In the yeai 1870, sheet iron was very little used for roofing or other building purposes; in 1887, there were over 50,000 tons of this material used for building purposes in the United States, showing that at present it stands ahead of any other article, and that its cheapness, durability and adaptability make it a most desirable article now in use for roofing. Among the pioneers in the use of sheet iron for roofing purposes were the Garry Iron & Steel Roofing Co., of Cleveland, B. F. Powers and G. E. Needham, proprietors. By their improved machinery, large capacity and superior advantages for shipping, they have established a wide reputation and have enjoyed a correspondingly flattering state of business prosperity.

Our illustrations embrace three only of a large number that are to be seen in their new catalogue, recently issued. Fig. 1 represents their roll lap roof, A showing the seam complete, B the riveting of the lap, C the lap partly off, D putting down the cleat and anchor, and E forming up the sides with roofing tongs.

Fig. 2 gives a view of their corrugated roofing, siding and ceiling. They make also medium and small corrugation and outside corrugations.

Fig. 3 shows a sample of crimped roofing and siding. This roofing is designed for a cheap class of buildings, such as rolling mills, furnaces, cotton sheds, barns, awnings, etc. It can be laid upon sheeting boards, cross strips or rafters, without sheeting boards. The advantage of their crimped roofing is, that a lock is formed on the end of the sheet before it is shipped, which makes it much better than lapping the ends, or forming the locks on the roof. It can also be laid without the use of the three-sided wood strip (V strip) or without forming the rafter to fit the crimp—thus saving the expense of the wood strip.

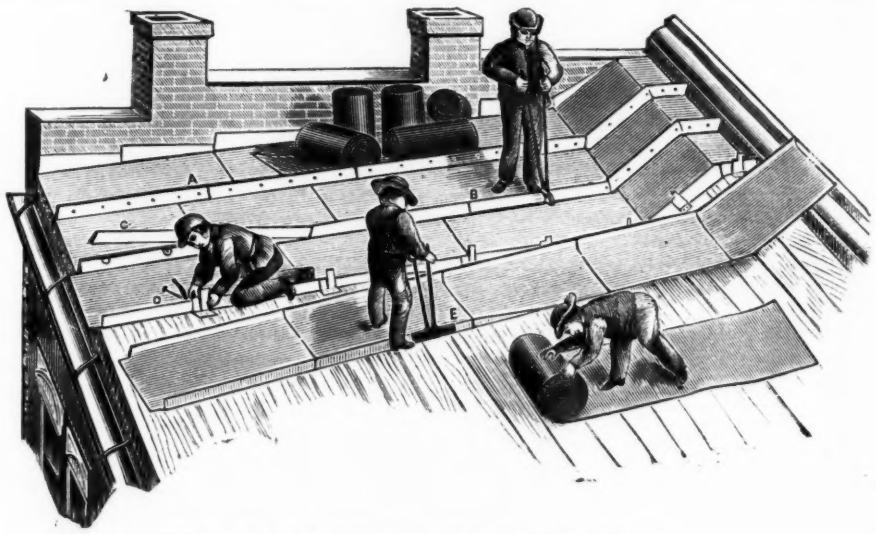


FIG. 1.—GARRY'S ROLL CAP ROOF, IN PROCESS OF LAYING.

FIG. 2.—CORRUGATED ROOFING, SIDING AND CEILING.

FIG. 3.—CRIMPED ROOFING AND SIDING.

THE ARTISTIC TREATMENT OF CAST IRON.

Mr. W. R. Lethaby lectured on this subject, given before the British Society of Arts, recently. The following are some suggestions as to methods of treatment:

If the uses are not few, the methods of treatment are many. We must, however, accept the necessary limitations that sculpture or ornament must be modeled, not carved, wherever it is proposed that the finished result should be a casting either in metal or other materials. The base may be wood and the ornament modeled in applied wax, which Viollet-le-Duc has stated to be the old method. The ornament, whatever it is, must be a surface decoration of a general simple structural form.

Repetition is of the very nature of cast work, and hence the same form as we have seen was often many times impressed in the same mould. Repetition of a few simple elements in different combinations made great actual variety possible, as in the firebacks.

As to surface, rust is without any doubt the natural treatment, and I believe we might well let nature have it so on occasion. Let us suppose a relief good in design, slight in finish, of the best iron, and absolutely untouched from the mould; put up under some simple pent, it will gradually acquire color and texture—too much of both, you think, but I am not sure. Remember first of all, how frightened we are of beauty; and that natural color and naturally acquired texture are the very adornments to beauty herself. A joke in Japan tells how the new srevant-maid from the country polished off Times' lovely tarnish from a silver vessel, "to make it look bright and new." The joke would appear pointless to us, even applied to the tombs of Westminister. Decay is really much less than we suppose, especially on large, rounded surfaces, and with even a small but constant amount of friction the metal keeps free of rust, or probably acquires a weather skin. Posts that block up roadways (of which there are a good many in Bloomsbury!), or the parapet of Westminister Bridge are examples; internal work, like the finely-designed gratings in Kensington Museum, becomes quite polished.

Galvanizing, the modern version of the tinning which, applied to iron, is as old as Theophilus, is a valuable process. Galvanizing and good oil gilding right over the surface would probably be a perfect protection, or the gavalnizing might be lacquered and varnished in one or many lustrous tints, or in black and gold patterns, like the iron beams of large scales, one of the simple decorations still done traditionally.

The black of Barff's process is also a valuable method; the Japanese set much store on a black oxide.

Electro-bronzing is another available method of which the French make use, and the dogs at Kensington are examples. Pliny tells us a statue at Rhodes was made of iron and copper for the sake of the color. We find it possible to get Japanese workmen here to furnish out a shilling show. Would it not be possible to get one or two to instruct us in their processes in iron-working, and especially in finishing and coloring the surfaces.

For some work oiling or varnishing may be sufficient, or thin Berlin black; in many cases of course painting is generally necessary, for which I would recommend white, grey, or black as constant colors, although the real red of the post-boxes is not an example to be followed. Simple blackleading, too, is to be entirely approved.

Some old gates are inlaid in brass, which forms flush patterns on the surface. Lead might also be suggested, say for patterns and inscriptions on flat slabs, and might be merely beaten into the hollows left in the casting; or even cements or mastics might be so inlaid, if only properly designed. Turning might be used to finish the forms of balusters of severe classic patterns.

Death of a Well-Known Iron Man.

A dispatch from New Castle, Pa., April 1, says: Alexander L. Crawford, the wealthiest man in New Castle, and among the wealthiest in Western Pennsylvania, estimated to be ten times a millionaire, died early this morning from a complication of diseases arising from an attack of la grippe. Mr. Crawford was born in Montgomery county, Pa., February 5, 1815, and came to New Castle, April 1, 1841. He was a pioneer in the iron interests of this city, having built the Etna mill and furnace, the new mill and the Crawford furnace. He erected the Lowell, O., furnace in 1853, and in 1847 he erected the one at New Wilmington, Pa.

In 1850, Mr. Crawford shipped the first Lake Superior ore that was ever sent out of Marquette, then a village of only a few houses. This territory, developed by him, has grown until, in 1889, nearly 8,000,000 tons of ore were shipped from that region. In 1866 he developed the immense block coal region near Brazil, Ind., and sank the first shaft opened there. In 1872–3 he built two furnaces at Terre Haute, Ind., but one of these has since been removed to Jackson, Ala. In 1878 he built the Sligo Furnace in Dent county, Missouri. He built a railroad with fifty-four miles of track which is called the St. Louis, Salem & Little Rock, and connects with the San Francisco line at Cuba, Mo. The road opened up large ore fields in Crawford, Dent, and Phillips counties, Missouri. He was one of the organizers of the New Castle & Beaver Valley Railroad, and has been its president since it was constructed. Mr. Crawford was in the company that built the Ashtabula & Pittsburg Railroad. He was largely interested in what was formerly the New Castle & Franklin, and was vice president of the National Bank of Lawrence County. Mr. Crawford had large interests in Tennesee and was interested in the construction of two railroads there—one from Nashville to Knoxville, which penetrated four counties and benefited 110,000 inhabitants along its line. Along this road he owned the largest body of block coal in the United States, comprising 50,000 acres. He had many other interests in that State profitable to him and beneficial to the people.

New Forging Process.

The distinction between melted metal flowing into molds by gravity, and being forced into molds by pressure, when only softened by heat, is not so great as people imagine. The first is as old as civilization, the latter is a new process, developed and made possible by implements of recent invention. All over the world press forging is increasing. Presses to exert thousands of tons are now common, and the most intricate forms are produced by the flow of metal heated only to redness, the same as it would be for hammering. Even here in San Francisco a good many things are being forged by pressure that were formerly cast, notably the parts of "cable grips" and like things are produced by "presses," nearly as cheap as castings of malleable iron or steel. The latest thing in such forgings are railway axles. Blanks of a uniform section are placed in dies which form a matrix having the form of the completed axle, with its necks and collars. Powerful plungers driven by hydraulic force, act on the ends of the blank forcing, or "flowing" it into the mold just as castings are made of fluid metal. The work demands celerity to prevent cooling by radiation, but the process is, no doubt, a practical and economical one.—[Industry.

Pennsylvania Iron & Steel Co. will build an iron furnace at Talladega, Ala.

WARREN'S RADIAL DRILLING MACHINE.

The fine cuts herewith given show a new balanced spindled six foot radial drilling machine, manufactured by W. H. Warren, 35 and 37 Hermon street, Worcester, Mass. Fig. 1 shows a side view, with drilling spindle in vertical position. Fig. 2 (page 9) is a front view, showing the drilling spindle in horizontal position. The balance weight runs on planed grooves and requires no adjustment in the positions shown. The height of column, including floor table, which is 6 inch deep, is 9 feet 1 inch. The height of the elevating screw in highest position is 12 feet. The greatest distance from bed B to center of spindle is 64 inches, with 13 inches more clearance in throat D. The head traverse on the arm is 50 inches; the arm radiates half circle. The distance from the spindle in the highest position to the floor table is 74 or 90 inches, but may be lowered to 19 inches; the arm has a vertical adjustment of 40 inches, and is raised and lowered by power. The head is moved on arm by mechanism, so arranged with gears and rack that the operative can move it quickly, having the advantage of being over his work instead of using

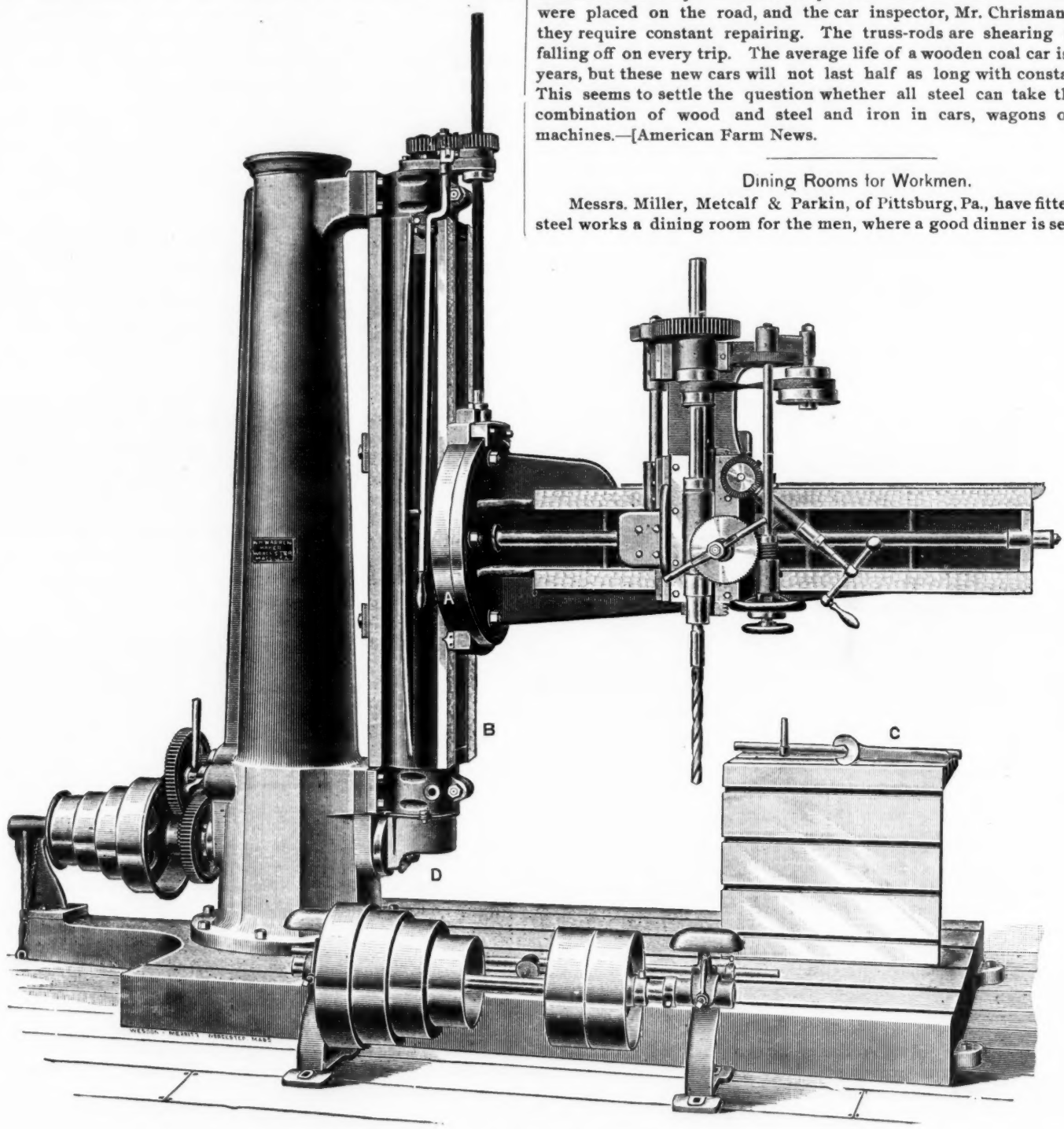


FIG. 1.—WARREN'S RADIAL DRILLING MACHINE.

screw at end of arm. Steel spindle is 2¼ inches diameter, 15 inches traverse driven by 3¾ inch belt, on cone of four changes of 15½″, 12½″, 10⅞″, 9 9-16″ diameter, back gears five to one, varied by eight motions. The arm can be turned to any degree, as it swivels on a graduated shoe A, which is planed on tracks on vertical bed B, on which it has bearing of 29 inches, secured by four large bolts. The utility of having the shoe planed on tracks is manifest when the operative desires to throw the arm over and drill in a horizontal position, as he can raise and lower the arm to accommodate drill and counterbore, and yet retain its exact position with the work. The quick return and feed act the same in all positions. The great distance between bearings on vertical bed B, obviates the necessity of tightening and loosening the grip bolts on surface drilling, thereby saving a large per cent. of time over the ordinary radial drill. C is a portable table, 27″ long, 23″ wide, stands 24″ high, which can be readily detached, and large work placed on floor table, the extreme dimensions of which are 127 inches long, 58 inches wide, provided with five planed slots. The shafts are steel, bearings long and large; all slides are scraped fits. Counter shaft and wrenches included with machine. The speed of counter shaft at 190 drives the spindle on the quickest speed 190, and on slowest, with back gears, 15 revolutions per minute. The pulleys are 13 inch diameter, 4 inch face. The shipping weight of the machine is 10,500 lbs.

Failure of Steel Flat Cars.

The Cleveland, Akron & Columbus railroad recently ordered five hundred coal cars for that line, and the first cars were delivered last Fall. The cars are quite handsome in construction and captivate at sight. Some years ago an attempt was made to build iron cars, but they went to pieces so much quicker than wooden cars, that the manufacturers were obliged to discontinue their construction. The builders of these new coal cars believe they have surmounted obstacles in the way, and have placed trusses and braces at every conceivable point to give the cars strength. The trusses and supports give them the appearance of an iron bridge. It seems, however, that there is a difference between an all iron bridge on wheels and an all iron bridge which remains stationary. It is now only about four months since these new cars were placed on the road, and the car inspector, Mr. Chrisman, reports that they require constant repairing. The truss-rods are shearing and the nuts falling off on every trip. The average life of a wooden coal car is about seven years, but these new cars will not last half as long with constant repairing. This seems to settle the question whether all steel can take the place of a combination of wood and steel and iron in cars, wagons or harvesting machines.—[American Farm News.

Dining Rooms for Workmen.

Messrs. Miller, Metcalf & Parkin, of Pittsburg, Pa., have fitted up in their steel works a dining room for the men, where a good dinner is served at a very low cost. This is a common plan in England, where such dining rooms exits in many of the large works, not only for the men, but oftener for the proprietors and the office staff, who eat their luncheon at noon in the works, and at the same time, have an hour of useful and instructive discussion. The Union Iron Works and the Pacific Rolling Mills Co. in this city, have adopted a similar plan for the staff, and the advantage will be obvious to anyone who has the good fortune of an invitation to luncheon at either of these works.—[Industry, San Francisco.

New Catalogue for Wood-w.rkers.

Wood-workers demand machinery for rapid and perfect production, they are then enabled to get their work out faster, and in larger quantities. The late improved time and labor-saving machines of the Egan Co., of Cincinnati, O., are now in the lead everywhere. A new catalogue is soon to be issued, which will be a handsome affair, containing cuts and descriptions of the largest line of recently improved wood-working machinery in the United States.

A LITTLE FREE ADVERTISING.

Newport, Ky., has acquired a rather unenviable notoriety as the home of the charlatan. The particular form assumed by the prevailing humbug was a lead furnace that would smelt all kinds of things and do wonders no other furnace ever did before. This was heralded as the invention of one Charles L. Hartsfeld, the company promoting the furnace being called the Hartsfeld Furnace & Refining Co. To give credit to the technical absurdities this inventor advanced, he caused to be printed on his cards the following puff, which, he asserted, had appeared in the *Engineering and Mining Journal:* "Mr. Hartsfeld has won fame as a builder of precious metal furnaces in Europe, and the merits of his present devices have already been recognized in many of our continental countries." We promptly published a statement in these columns that no such endorsement, or any endorsement whatever of this man or his furnace, had ever appeared in the *Engineering and Mining Journal*, and, upon our request, Mr. Hartsfeld promised to withdraw these circulars and cards.

We have recently received another circular of the Hartsfeld Furnace & Refining Co., in which this old endorsement appears credited to the *Engineering and Contract Journal*, New York, June 20, 1885. No such paper exists or existed at that time, and this is only a thin disguise, used with the hope of misleading the public into believing the *Engineering and Mining Journal* had given him its endorsement.

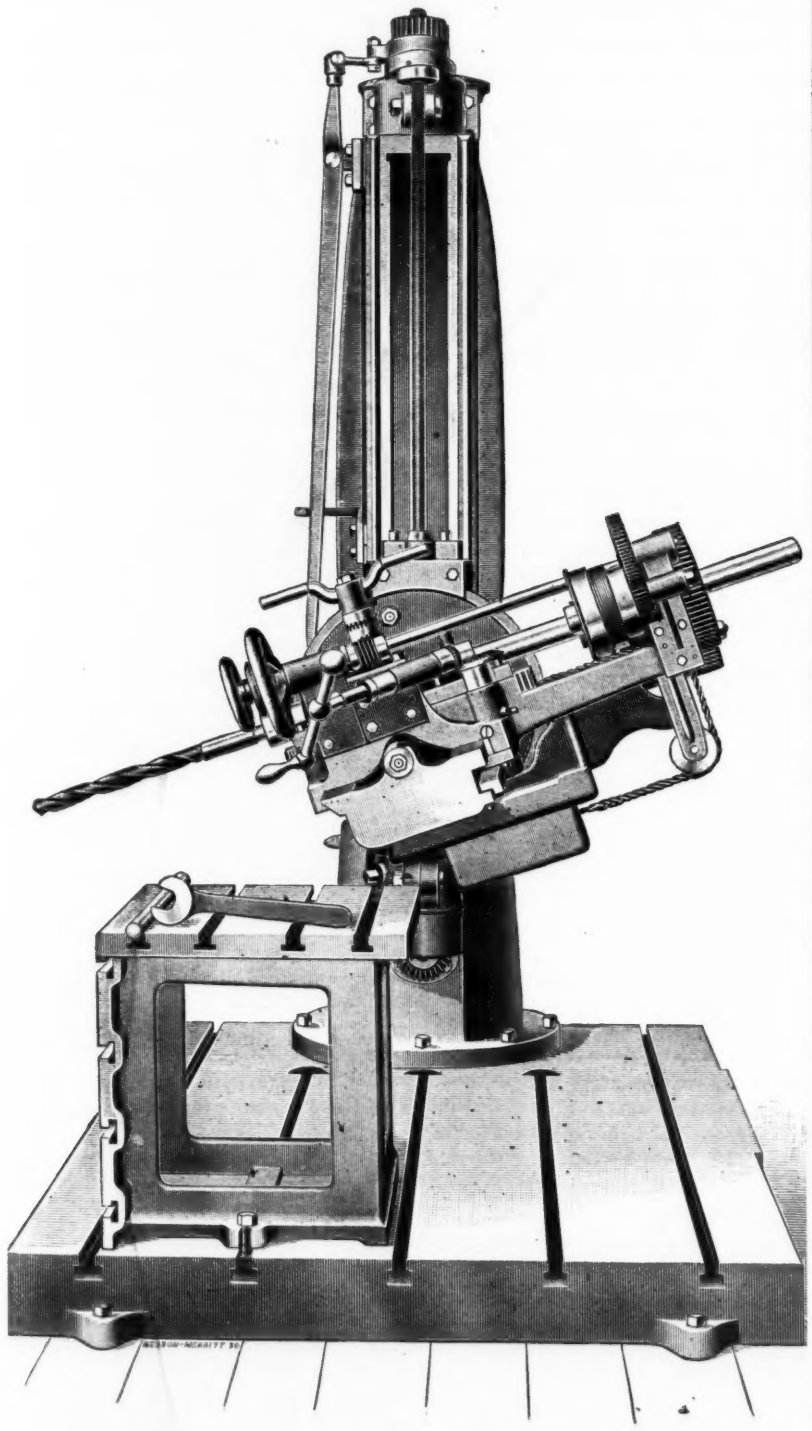


FIG. 2.—WARREN'S RADIAL DRILLING MACHINE. (See opposite page)

Our opinion of Mr. Hartsfeld, president and manager, and of the Hartsfeld Furnace & Refining Co., is that they are unmitigated humbugs, wholly unworthy of credit. They now pretend to produce aluminum in the old water jacket furnace which formerly did duty as a lead and copper furnace—a pretense without a shadow of foundation.

This concern has purchased aluminum from Col. Frishmuth, of Philadelphia, whose bills, we believe, were not paid, and has recently bought the metal from the Pittsburgh Reduction Co., and has purchased alloys of aluminum from the Cowles Electric Smelting Co. What was thus purchased has been paraded and advertised as made by this Hartsfeld concern, and a new company is organized and the stock sold on this ficticious reputation.

Whenever one form of humbug has been exploited as far as it will pay a new one is started. We have received a new circular describing the virtues of "Schmiedbarénguss" (aluminum wrought iron castings). The same old water jacket seems to do duty for this also, and the new company is "The Schmiedbarenguss Furnace Company of Newport, Ky.," with Mr. Hartsfeld modestly among its directors. A correspondent suggests that it should be called "The *Schneid*-barenguss Furnace Company." This concern buys aluminum in Pittsburg, and it is simply a new face on the old humbug. We trust none of our readers will be deceived by it.

It is needless to criticise in detail the statements made in the Hartsfeld circulars, the head of the concern who apparently edits them is evidently a charlatan without metallurgical knowledge and the concerns which start from that course are more or less humbugs, which pay their debts in some cases and in others do not. The "Schmiedbarenguss" is only the old Mitis mixture of aluminum and melted iron, and, so far as we have been able to ascertain, presents no novel features.—[Engineering and Mining Journal, New York.

A Mr. Hatzfeldt, of Newport, Ky., has discovered a new metal. He has also discovered a good many other new things. Among them some smelting furnaces not unknown on this coast. Newport contains a barracks, a saw mill or two and is a suburb of Cincinnati, on the opposite shore of the Ohio river, mainly a place of residence for Cincinnati people. Why it is selected as the birthplace of the Hatzfeldt inventions, no one can tell. The late Mr. W. T. Garratt went once upon an exploring expedition there, and his experience of the Hatzfeldt establishment was far from satisfactory. The new metal is called "Schmiedbarengus" or letters to that effect.—[Industry, San Francisco.

Iron Sand in New Zealand.

News from New Zealand states that a method of fluxing the iron sand which abounds on the west coast there has been discovered. Every one who is acquainted with the commercial resources of New Zealand is aware that it possesses on the coast immense stores of iron stone of remarkable richness. Hitherto no economical method of securing a flux of that sand has been discovered. Authorities agree that if the valuable mineral sand there found could be brought into commercial use, New Zealand would at once become one of the most important iron-producing countries in the world. It is not surprising, therefore, that the announcement of the alleged discovery has created a very great sensation.

The statement is that Messrs. Minall & Jones have discovered a process which they are, of course, keeping secret until it has been protected by patent. They have prepared a quantity of the fluxed iron sand for the blast furnace, and when the mail left, a temporary furnace was being erected to run the metal off into pigs. In this country some hesitation is evinced in accepting the truth of this report. That a flux is in existence is well known. That, however, is not sufficient, it must be economical; and the accounts received from New Zealand give no indications of the cost at which this sand can be used. It is not a question of practicability, but of expense, and what is required to make New Zealaud an important iron centre is that an economical flux should be discovered. A short time ago something was heard in London of a company which was to test the petroleum deposits and the iron sand of New Zealand, but it was subsequently stated that so far no economical available means of dealing with the iron sand had been discovered. Therefore, until there is a clear evidence that some one can not only deal with the iron sand, but deal with it economically, all reports, as the one now to hand, will be received here with a good deal of scepticism.—[British Manufacturer.

Alarm for Hot Bearings.

A journal devoted to new inventions gives an account of an alarm for hot journal bearings, the invention of one Christian Agerskov, of Copenhagen, Denmark. The idea embodied is to arrange an explosive, in association with certain chemicals, so that a certain degree of heat will cause the explosion and warning before the heat reaches a destructive stage. A small sheet of sheet metal—something like a cartridge shell—is filled about half way to the open top of the explosive. A paraffine globular capsule, hollow inside, is filled with sulphuric acid and sealed. This globule is laid on top of the explosive, and a mixture of chlorate of potash and sugar is filled in all around it; then a stopper or plug of cork or rubber is put in, sealing the cartridge. A hole is drilled in the box or bearing and the cartridge set in. Should the bearing run dry, the heat will melt the paraffine capsule, letting the sulphuric acid come in contact with the chlorate and sugar mixture, which will immediately explode the cartridge, causing a loud detonation and a light and volume of smoke, so that attention is immediately called to the condition of the bearing. This invention has wonderful merit and has been patented in many of the European countries.

The Lake Superior Mine Strike.

We believe that *The Iron Trade Review*, in its comments of the ore market of the past week, greatly overestimates the influence of the so-called "strikes in the Lake Superior region." All the labor disturbances to date have been purely local in character, and ephemeral at that. Among the employes of the Lake Superior mines, as a class, we believe that the best of feeling prevails and that no labor disturbances of serious nature will occur this year to result in an unfortunate limitation of the output. Strikes are very rare in the copper and iron regions of the upper peninsula, and certainly there is nothing in sight which could be expected to impair the good feeling now existing between employers and employes. The mines of Lake Superior will far surpass all previous records this year—so much can be confidently relied on by the iron men of Ohio and Pennsylvania.—[Marquette Mining Journal.

INDUSTRIAL SUMMARY.

New Enterprises :—

The Weldman Low Water Alarm Co. is a new corporation at Saginaw, Mich. Capital stock, $100,000.

The Walkerville Malleable Iron Co., of Walkerville, Ont., has been incorporated with a capital stock of $100,000.

Col. Walter Cutting is president of a new tack company which has been formed in Pittsburgh, with a capital stock of $5,000.

Lanier Bros., of West Point, Ga., will probably organize a $50,000 stock company to establish foundry and machine shops at Americus, Ga.

Articles of incorporation have been filed at St Louis, Mo., by the Elsonite Roofing Co., with a capital stock of $8,000; incorporators, Otto L. Teichmann, Ernst A. Hohn, Paul B. Fenske.

W. S. Raynor, Howard Carlton and others are reported as organizing a company to establish an iron foundry at Curtis Bay, Md. The capital stock will be from $100,000 to $200,000.

The Moses P. Johnson Machinery Co., with a capital stock of $45,000, has filed articles of incorporation at St. Louis, Mo.; incorporators, Moses P. Johnson, D. L. Johnson, M. L. Seward.

The Eno Steam Generator Co., of Canada, with headquarters at Toronto, will be organized with a capital stock of $100,000 for the manufacture of steam appliances.—[Canadian Manufacturer.

S. E. & J. W. Noble, D. T. Parker and J. R. Roberts are the incorporators of the Marble City (Ala.) Land & Furnace Co., organized to erect an iron furnace at Sylcauga. The capital stock is $1,000,000.

It is reported that the stockholders of the Baker Wire Co., and the Joliet Enterprise Co., of Joliet, Ill., propose to organize a new company to be called the Western Wire Co., for the purpose of supplying their works with wire rods.

Denver capitalists are reported to be behind a project to erect a large steel plant in Colorado, to be operated by a company having a capital of $1,500,000. The idea is to work the Adams direct process, and control the same in Colorado.

It is stated that W. B. Brooks, James Sloan, Jr., W. C. Frick and other parties will organize a stock company to establish bridge works at Curtis Bay or Canton, Md. The capital stock is to be not less than $250,000 nor more than $500,000.

The National Electric Light & Power Co., of Arkansas City, Kan., has been incorporated; capital stock $50,000. Directors—W. A. Thomas and J. F. Saunders, of Guthrie, Oklahoma, and M. F. Bailey, Charles Hutchins and E. L. McDowell, of Arkansas City.

The Midland (Va.) Steel & Iron Co. has been organized to manufacture Bessemer steel, with a capital stock of not less than $100,000 nor more than $5,000,000. The incorporators include Hon. John W. Daniel, John H. Inman, of New York City; M. M. Rogers of Roanoke, and others.

A company with a capital stock of $500,000 have been organized at Pittsburg to manufacture electric mining machines under the invention of M. A. McMichaels, of Pittsburg, and Dr. O. S. Weddell, of McKeesport, Pa. It is probable that the plant of the new company will be located at McKeesport, Pa.

The Neracher Sprinkling Co., Warren, O., is another new incorporation for that thriving town. The company is largely composed of Cleveland capitalists, says the *Chronicle*, and their specialty will be the manufacture of a sprinkling apparatus for large mills and factories and adjusted automatically so that at a certain degree of heat the valves open and the entire building so outfitted is deluged by the mere heat of a blaze acting upon the apparatus. Immense quantities of tubing are used in piping the buildings, and the stockholders, who are also interested in the Paige Tube Works, are desirous of having the new concern located in close proximity to the source of tubing supply. The plant will include a foundry, and will employ not less than 50 men at starting, with a possibility of large increase in force. The capital stock is $70,000.

Recent Illinois incorporations: Enterprise Gold Mining Co., of Butte county, Cal., Chicago; for mining and milling in gold ores; capital, $100,000; incorporators, C. G. Ferguson, E. P. Beam, and A. T. Zenan.—Aluminum Mfg. & Car Co., Chicago; to manufacture aluminum and construct railway cars; capital, $1,000,000; incorporators, S. W. Adams, A. R. Wilson, Nicholas Heinson.—Whitney Mfg. Co., Chicago; to manufacture patented articles; capital, $25,000; incorporators, Robert Ryan, M. J. Bartlett, C. W. Whitney.—Hydraulic Cold Air Power Co., Chicago; to manufacture machinery and car motors upon a patented plan; capital, $500,000; incorporators, W. G. McLaughlin, R. D. Baldwin and John Good.—Providencia Gold Mining Co., Chicago; to do a mining business; capital, $2,400,000; incorporators, A. Waldejo, F. E. Boyner, and A. H. Chetlain.—Chicago Railway Supply Co., Chicago; to manufacture railway supplies; capital, $300,000; incorporators M. N. Grable, E. M. Walker, T. A. Quinlan.—United States Gas Saving Co., Chicago; to deal in gas saving appliances; for engines; capital, $50,000; incorporators, Malcomn McNeil, W. N. Low, C. W. Laing.—Consolidated Barb Wire Co., Chicago; to do a general manufacturing business; capital, $50,000; incorporators, E. A. Rice, H. H. Waters, C. H. Keikham.—Beach Pneumatic Conveyor Co., Chicago; capital, $500,000; for the manufacture of machinery and pneumatic pipe lines for the collection and transfer by pneumatic process of the mails, grain and other commodities; incorporators, T. Michener, J. W. Beach, F. C. Shayes, and others.—Beach Pneumatic Mill Co., Chicago; to maintain and operate in the city of Washington a system of pneumatic pipe lines for transfer to a common center of mail matter; capital, $100,000; incorporators, A. C. Reid, J. W. Beach, L. T. Michner.—National Engraving Machine Co., Chicago; to manufacture engraving machines; capital, $100,000; incorporators, C. C. Bruskner, J. W. Callahan, and J. B. Gallaway.—Joliet Wire Nail Co., Joliet; to manufacture wire and nails; capital, $80,000; incorporators, W. S. Brooks, C. L. Beale, and A. G. Duysters.—Mills Adjustable Parlor Car Chair Co., Chicago; capital, $150,000; for the manufacture of adjustable chairs for railroad cars and offices; incorporators, William F. Mills, James Murison, James L. O'Donnell, Charles H. Warren, Thomas H. Watts.—Illinois Bolt & Nut Co., Peoria; to manufacture bolts and nuts; capital, $100,000; incorporators, W. J. S. Stevens, G J. Gibson, T. E. Magee.—Chicago, Railway Supply Co., Chicago; to manufacture railroad supplies; capital stock, $300,000; incorporators, N. Grable, E. M. Walker, and T. A. Quinlan.—Chicago Stove Fixture Co., Chicago; to manufacture stove fixtures and kindred articles; capital stock, $10,000; incorporators, A. F. Nastali, E. Hechniger and C. F. Lange.—American Electric Supply Co., Chicago; to manufacture all kinds of electric apparatus; capital stock. $250,000; incorporators, F. E. Shaw, William Martin, W. O. Johnson.—Royal Sewing Machine Co., Rockford; to manufacture sewing machines; capital, $100,000; incorporators, John A. Johnson, O. Bergguist, John A. Budlong.— Pneumatic Co., Chicago; to operate pneumatic tubes and machinery; capital, $250,000; incorporators, J. C. Becks, W. L. Lemaier and E. R. Becks.— Western Wire Co., Chicago; to manufacture wire nails; capital, $200,000; incorporators, G. B. Baker, P. A. Noble and F. H. Connell.

Enlargements, Additions, Removals, Etc.:—

The St. Louis Electric Light Power Co., of St. Louis, filed a statement of increase of capital stock from $8,000 to $30,000.

The Columbia (Ala) Variety Works will rebuild and enlarge its machine shop and add a foundry and buggy and wagon factory.

The stockholders of the Turner Rapid Heater Co., of Meriden, Conn., have voted to increase the capital stock of the company from $20,000 to $100,000.

W. J. Houlihan has, it is reported, purchased the Enterprise Machine Works, at Mt. Sterling, and formed a $50,000 stock company, to remove same to Lexington, Ky.

An immense brass and iron foundry will be built at Kokomo by the Oshkosh Iron Pump Works, which will remove from Oshkosh to that place. Work commences at once.

The Meriden Machine Tool Co., Meriden, Conn., who succeeded A. T. Booth & Co. recently, have the following officers: H. Wales Lines, president; R. L. Peck, treasurer; W. L. Cheney, secretary, and are preparing to manufacture a variety of machines, tools and brass working machinery. At present they are turning out forming lathes, principally.

Furnaces and Works Starting Up:—

The Lackawanna Coal & Iron Co., of Scranton, Pa., recently started its third converter. The company is building an additional blooming mill.

Wharton furnace, formerly the Port Oram, at Port Oram, N. J., was blown in last week. The furnace has been thoroughly remodeled and its height raised to seventy-five feet.

The Riverside Iron Co.'s blast furnace, at Benwood, W. Va, has again gone into blast. This company's nail factories are idle for repairs, and all the other departments are running in full.

The rolling mill at West Hamburg, Berks county, Pa., owned by the Reading Co., has resumed operations after being idle for four years. The mill has been leased and will be operated by the Pottsville Iron & Steel Co.

Fires and Accidents :—

Unionville, Conn.—The works of the Upson Steel Co. were burned on the 31st ult.

Lima, O.—The Globe Machine Works was damaged by fire, March 27th, to the extent of $3,000.

Milwaukee, Wis.—The works of the Northwestern Malleable Iron Co. was badly damaged by fire April 7. The crude oil used for fuel was kept in a tank 600 feet away, and was led to the boiler through pipes. It is thought that considerable gas must have formed, for when the engineer began firing up in the morning, an explosion took place, hurling him into the yard and enveloping the building in flames. The plant was valued at $80,000 and was insured for about $30,000. The loss is estimated at from $40,000 to $45,000.

General Industrial Notes:—

In the month of March the Scranton Steel Co., of Scranton, Pa., produced with two 6½-ton converters 22,043 tons of ingots. In the same month the rail mill turned out 19,121 tons of steel rails.

The City Engineer of Buffalo has been ordered to prepare plans for an iron bridge, to be built across Scajaquada Creek at the crossing of Grant street, to replace the present 600-foot wooden structure.

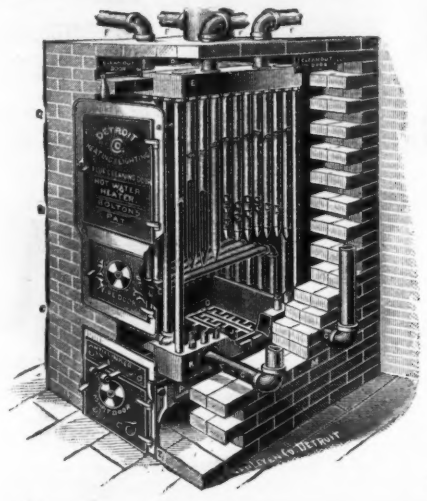
The Harrington & King Perforating Co., of Chicago, have just added 40x166 feet to their floor space, which they are filling with machinery rendered necessary by the continued expansion of their business.

Wm. Tod & Co., Youngstown, O., shipped a blowing engine the past week to the Vanderbilt Iron & Steel Co., of Birmingham, Ala. Messrs. Wm Tod & Co. have more propositions out now than ever before.

One day last week a roller at the Carbon Iron Co.'s works, Pittsburgh, Pa., turned out a surprising piece of work. It was a plate seven eighths of an inch thick, 30 inches wide and 85 feet long, and, when finished, weighed 7 480 pounds. The plate was worked from the ingot with but one heating.

On Friday, the 28th ult., Charles M. Schwab, superintendent of the Edgar Thomson Steel Works, of Carnegie Bros. & Co., Limited, Pittsburgh, Pa., sent the following telegram to Andrew Carnegie in New York City: "Our output for yesterday: Ingots, 1,648 tons; blooms, 1,513 tons; rails, 1,417 tons." In answer to the above, Mr. Carnegie sent the following: "That will do; stick a pin there, and make the average 1,400 next year. Hearty congratulations." This is the best day's record made so far at these works, although it is liable to be eclipsed at any time.

BOLTON



Best for Warming Dwellings, Greenhouses, Schools, &c.
Most Economical, Durable and Easily Managed.

HOT-WATER HEATER

Safe. Clean.

BEST RECORD IN CANADA AND THE BLIZZARD NORTHWEST.

And Radiators.

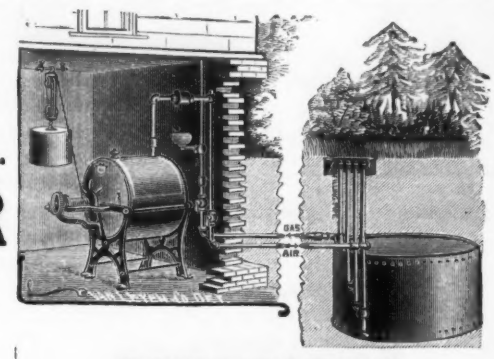
Its Vertical Circulation renders its action Prompt and Rapid.
Its Fire Surface is the largest in proportion to Grate Surface.
No Bolted, Flanged or Packed Joints; therefore cannot Leak.
Its Brick Casing entirely prevents loss of Heat in Cellar.
Wrought Iron; therefore cannot Crack.

WEBER STRAIGHTENING VALVES.

Send for Circulars.

Detroit Heating & Lighting Co.,

88 Lake St., Chicago, Ills. 396 Wight St., Detroit, Mich.



COMBINATION

Gas Machine

Best Independent Gas Apparatus

For Country and Suburban Residences, Churches, Schools, Stores, Hotels, Etc.

Over 20 Years in use, with never an Accident.

Average cost of gas, ½ cent per hour per burner.

FREE FUEL! FREE LIGHT!

FREE MANUFACTURING SITES!

At Muncie, Ind.

THE NATURAL GAS CITY OF THE WEST.

Manufacturers can save their entire fuel and light expense by locating at Muncie. Railroad center. Cheap freight rates. Oceans of Natural Gas. Plenty of water. In the last eighteen months twenty new manufactories have located here.

For full particulars address

Muncie Natural Gas Land Improvement Company,

E. G. RIDEOUT, GENERAL MANAGER, MUNCIE, IND.

Bonnell's Nubian

IRON - ENAMELS.

The most complete line of Blacks for iron ever offered the trade. Put up in all sizes, from ½-pint can, with brush for home use, to 50-gallon barrels. Of all grades, from the cheapest dipping black to the finest bicycle enamel made.

THE NUBIAN IRON ENAMEL CO.,

Sangamon and Jackson Sts., Chicago.

"Treated" COTTON, Rubber Lined

Fire and Mill Hose.

Fabric Fire Hose Co.,

5 BARCLAY ST., NEW YORK, N. Y.

HERE IS YOUR CHANCE.

Can any one make better club rates than the following?

						Per Year.
Scribner's,	Monthly,	with	IRON	TRADE	REVIEW,	$4.50
Century,	"	"	"	"	"	5.50
Cosmopolitan,	"	"	"	"	"	3.50
St. Nicholas,	"	"	"	"	"	4.50
Frank Leslie's Popular,	"	"	"	"	"	4.5
Frank Leslie's Budget of Wit,	"	"	"	"	"	4.00
Frank Leslie's Pleasant Hours,	"	"	"	"	"	3.50
Outing,	"	"	"	"	"	4.25
Life,	Weekly,	"	"	"	"	5.75
Texas Siftings,	"	"	"	"	"	3.00

Send your subscriptions to the

CLEVELAND PRINTING & PUBLISHING CO., Cleveland, Ohio.

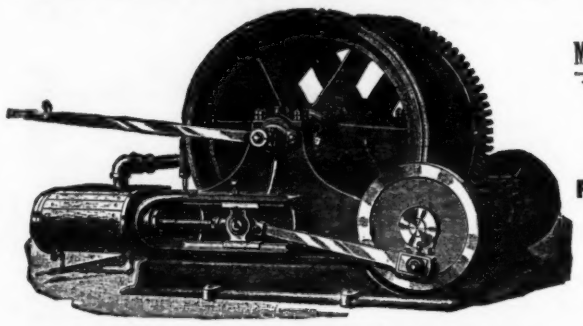
THE BINDING-TWINE TRUST.

Not long since the *Industrial World*, in a controversy with *The Iron Trade Review* about the possibility of a corner in Bessemer pig iron, to strengthen its position stated that "the men who organized the binding-twine trust thought they had farmers on the hip, and could dictate any prices they chose; but the farmers offered a round sum for an invention which would bind with straw in the field, and they have secured a machine which delivers them forever from the clutches of the trust. Are there no equivalent contingencies which might beset and nullify an attempted corner in Bessemer pig?"

If the expectations thus expressed had no better foundation than the correlative illustration quoted, then they have but little chance of realization. When the above statement was made, every person well informed in these matters knew that there was no "binding-twine trust," that no binder like the one referred to had yet been produced for practical use, nor ever will be in all probability, and that according to the reports the farmers had not secured the machine about which there has been so much talk. A thoroughly reputable journal, like the *Industrial World*, should be more careful in its statements.—[Farm Implement News, Chicago.

THE new advance of 5 per cent. gained by the Yorkshire, Eng., miners and the five per cent. in July make their say 40 per cent. above what they were paid two years ago.

"BACON'S" WINDING ENGINES



FOR Mines, Inclines, Quarries AND EVERY POSSIBLE DUTY WITH Friction Drums, Link Motion.

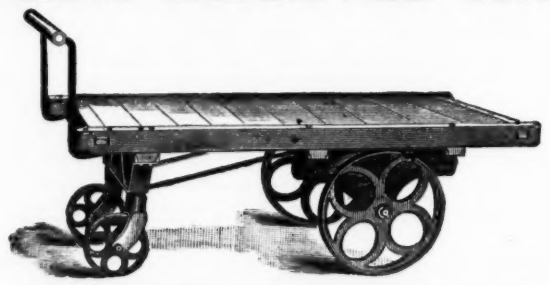
DOUBLE OR SINGLE DRUMS.

Complete Hoisting and Mining Plants a Specialty.

COPELAND & BACON, 85 Liberty St., N. Y.

535 ARCH ST., PHILADELPHIA, PA.

- LANSING IMPROVED TRUCK. -



Made by **Lansing Wheelbarrow Co., Lansing, Mich.**

Write for Catalogue of Iron, Steel and Wood Barrows and all styles of Trucks.

THE CHEAPEST

ALUMINUM,

AS WELL AS THE BEST,

Is offered to the Trade by the

Cowles Electric Smelting & Aluminum Co.,

CLEVELAND, O.

Price, $2 per pound for Aluminum contained in an alloy with copper, and $1.60 per pound when alloyed with iron, the same being subject to analysis.

—MANUFACTURERS OF—

Manganese Bronze, Aluminum and White Silver Bronze. Heavy Castings a Specialty.

Standard Fibre-Ware.

STANDARD FIBER-WARE COMPANY — STANDARD — MANKATO, MINN.

Water, Dairy, Fire and Chamber Pails, Wash-Basins, Spittoons, Slop Jars, Mats, Etc., are

USED BY EVERYBODY

who knows its merits, because it is

Handsome, Cleanly, Durable,

and is made from Flax Fibre, in styles plain and decorated, white and colored, and is

SOLD BY ALL DEALERS

Who keep abreast with the times. None genuine without this trade-mark. See price list elsewhere. Send for catalogue, etc.

IF YOU ARE

BUILDING

Write us for a copy of our book on

"A TIN ROOF,"

ALSO OUR

FORMULÆ,

Containing full information about tin roofing; showing how to select, lay and paint; and how to specify a tin roof in order to obtain best results.

Either or both pamphlets sent FREE OF COST.

If your building needs Ventilation, or you are troubled from downward draught in your chimney, write us for information relative to our

STAR ★ VENTILATOR.

MERCHANT & CO.

PHILADELPHIA. CHICAGO.
NEW YORK. LONDON.

To Those Looking

—FOR—

Manufacturing

SITES

IN THE SOUTH.

THE MOST DESIRABLE LOCATIONS IN THE SOUTH for manufacturing wagons, stoves, agricultural implements, furniture, or for foundries, machine shops, rolling mills, muck bar mills, nail works, glass works, cotton or woolen mills, and tanneries, are to be FOUND IN VIRGINIA along the line of the Norfolk & Western Railroad from Norfolk to Bristol and upon its branch lines. HARD WOOD OF EVERY VARIETY; PIG IRON from the furnaces at Lynchburg (2), Roanoke (2 in operation and 1 now under construction), Pulaski (1), Ivanhoe (1), Radford (1 to be built in 1890), Salem, Graham, Max Meadows and Bristol (1 at each point now under construction); bar iron from the rolling mills at Roanoke, Lynchburg and Richlands (1 to be built in 1890); COKE AND SEMI-BITUMINOUS COAL **from the Pocahontas Flat Top Field**; SUPERIOR GAS COALS from mines on the Clinch Valley extension; GLASS SAND from Tazewell Co.; COTTON FROM THE MARKETS of the Southern States, and Wool from all the Western and Southwestern States and Territories, at advantageous freight rates. FAVORABLE FREIGHT RATES made upon raw materials to all factories established upon its line, as well as to points in the United States and Territories, upon the manufactured articles.

Those seeking new fields for manufacturing establishments should not fail to investigate **the wonderful development of Iron, Coal and Coke Industries that has been made within the past five years along the line of the Norfolk & Western Railroad, and the advantages offered by the State of Virginia in the supply of cheap raw materials, by the Norfolk & Western Railroad** in the matter of freight facilities and rates upon raw materials and for reaching home, far distant and foreign markets, and by the cities and towns along its line in the way of advantageous sites, at moderate cost. Many of the cities and towns exempt manufacturing establishments from taxation for a series of years.

For further information as to freight rates and sources of supply of raw materials, apply to A. POPE, General Freight Agent, Roanoke, Va., or to

CHAS. G. EDDY.

Vice-President,

ROANOKE, VA

DAY'S

Instantaneous Heater

—AND—

BATH TUB COMBINED.

The only Portable Folding Bath Tub made. Can be stored in space 2½x2½x6 feet.

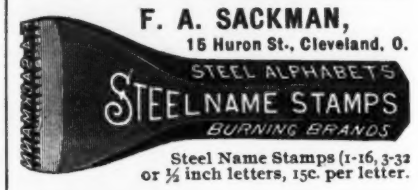
Can be moved from bath-room to sick-room.

Write for catalogue and discounts.

Made by **The DAY MFG. CO., Detroit, Mich.**

F. A. SACKMAN,

15 Huron St., Cleveland, O.



Steel Name Stamps (1-16, 3-32 or ½ inch letters, 15c. per letter.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. — HARTFORD, CONN.

GEO. P. BURWELL, Gen'l Agt., 208 Superior St., Cleveland, O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland, O.
A. D. BAITH, Special Agt., 208 Superior St., Cleveland, O.
R. D. BRIGGS, Special Agt., 208 Superior St., Cleveland, O.
J. E. WOLCOTT, Special Agt., Akron, O.

Two Books for Foundrymen.

AMERICAN FOUNDRY PRACTICE.

BY THOS. D. WEST.

Treating of Loam, Dry Sand and Green Sand Moulding, and containing a Practical Treatise upon the management of Cupolas and the Melting of Iron.

West's Moulder's Text-Book

Being Part II of American Foundry Practice.

Presenting best methods and original rules for obtaining good, sound, clean castings, and giving detailed description for making moulds requiring skill and experience.

Also containing a practical treatise upon the construction of cranes and cupolas, and the melting of iron and scrap steel in iron foundries. Either of the above books will be sent by mail, postage paid, $2.50. Address

CLEVELAND PRINTING AND PUBLISHING CO.,

CLEVELAND, OHIO.

Engineers' Specialties. The Crescent Lubricating Compound and Automatic Grease Cups will effect a saving of 75 per cent. over oil. Investigate their merits. **CRESCENT MFG. CO., Cleveland, O.**

PATENTS OSBORNE & CO., Patent Attorneys, 29 Euclid Ave., Cleveland, O. **U. S. and Foreign Patents Procured.** Patent Cases Litigated. Searches and Opinions as to Scope, Validity, Infringement and Title of Patent. Send for pamphlet.

PERFORATED METALS OF EVERY DESCRIPTION BY THE HARRINGTON & KING PERFORATING CO. CHICAGO.

PUMPS

Centrifugal, Rotary and Piston Power Pumps, and House Pumps.

OVER 800 VARIETIES OF BRASS AND IRON LIFT AND FORCE PUMPS.

☞ Send for Illustrated Catalogue.

RUMSEY & COMPANY, (LIMITED.)

New York City Office: 16 Dey Street. **Factories: Seneca Falls, N. Y.**

ESTABLISHED 1849. INCORPORATED 188.

The Detroit Saw Works,

MANUFACTURERS OF

CIRCULAR, GANG, DRAG, MULAY & BAND

SAWS.

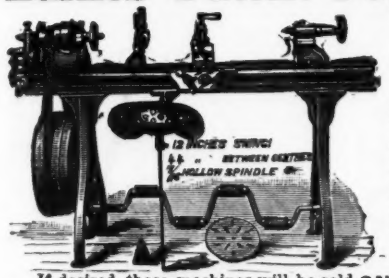
Moulding and Planer Knives, Emery Wheels and General Mill Supplies.

It will pay you to get our prices and guarantee.

66, 68, 70 and 72 Fort St., East,

Mention this paper. **DETROIT, MICH.**

Barnes' Patent Foot Power Machinery.



Complete outfit for Actual Workshop Business. Lathes for Wood or Metal. Circular Saws, Scroll Saws, Formers, Mortisers, Tenoners, Etc., Etc.

Our Patent Velocipede Foot-Power is without question the best yet applied to Lathes. Read a few expressions from those using them: "I do not see how your lathes can be produced at so low cost." "The velocipede foot-power is simply elegant." "Can turn a whole day, and feel as little tired as though only walking around." "In regard to the velocipede foot-power, I consider the lathe without an equal." "I sat at the lathe for 11 hours, cutting off and threading 1¼ steam pipes. Those who saw it declared it equal to 15 hour job in machine shop." "Using the velocipede foot-power, the operator can hold a steady hand for doing the work." "For doing actual business, the lightest or the heaviest, give me the velocipede foot-power." "The 4½ Lathe is equal to any costing twice the money." "What astonishes me is, how you can make machines to pay you for so small sum of money." "The No. 6 Lathe is the most perfect tool I ever saw for the money." "I can do double the amount of work on the velocipede, that I can on any other style of foot-power lathe." "There is no tax on strength, the body is at rest, steady, the hands and attention free for the job." "The velocipede.—It is the best foot-power of any for lathes."

If desired, these machines will be sold **ON TRIAL**. The purchaser can have ample time to test them in his own shop and on the work he wishes them to do. Descriptive Catalogue and Price-List Free. **W. F. & JOHN BARNES CO., No. 827 Ruby St., Rockford, Ill.**

HERCULES POWDER

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE Known to the Arts.

POWDER, FUSE, CAPS, Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING

FOR SALE BY THE

HERCULES POWDER COMPANY,

40 Prospect Street, Cleveland, Ohio.

J. W. WILLARD, Manager.

HERCULES, THE GREAT STUMP AND ROCK **ANNIHILATOR.**

The Improved "Luminator."

The cheapest and best artificial light in the world for Foundries, Boiler Shops, Steel and Iron Works, Railway Docks and Wrecking Trains and all indoor and outdoor work where a large space is to be lighted.

The **only** lamp that can be run either with compressed air or direct application of steam.

The **only** lamp that can use **Ohio Crude** or **Fuel Oil** in its natural state and guaranteed to furnish a steady, soft and brilliant light, free from smoke and of 2,000 candle power, or sufficient to light an area of 175 feet, at a cost not to exceed 4 cents per hour.

Readily set up, easily adjusted and perfectly safe.

Responsible parties may have this lamp on trial for 15 days, and if not satisfied may return it to factory free of cost. Send for circular and mention this journal.

WHEELOCK & CRICHTON,

D. R. LEAN, Manufacturer, Pittsburgh, Pa. SOLE AGENTS, **168 Washington St., Chicago, Ill.**

Art Printing.

Yes, ART PRINTING. Not the hybrid productions, with a few distorted brass rules and a congruity of illy-balanced lines of type, palmed off nowadays as Art Printing.

Send for or come in and examine our samples of fine work of original design, with an elegant, modern and striking appearance.

If you are in doubt as to what you want and are undecided as to style, etc., you are just the party we want to see. We have a faculty of pleasing the over-particular man.

The Cleveland Printing & Publishing Co. Cor. St. Clair & Wood Sts. Telephone 852.

CLEVELAND, O.

"RELIABLE" STEEL PLATE CABINET GAS STOVES

FOR COAL, WATER AND NATURAL GAS.

EIGHTEEN SIZES.

Finest in the World.

Beautiful finish; tile and nickel ornamentation.
Perfect combustion and very economical.
Burns less gas than any other.
Ovens and broilers 17½"x15"x12".
Ovens perfectly ventilated. Something new in gas stoves.
Are ready to bake before others get warm.

Notice our new attachment, a half low shelf for wash-boiler or other heavy vessels. Double burners on shelf.

Our RELIABLE and NEW LYMAN

GASOLINE STOVES

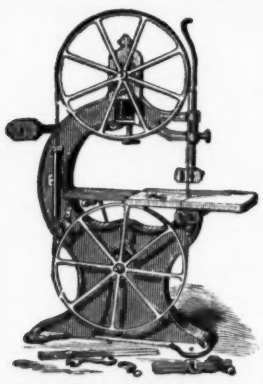
ARE LEADERS.

Natural, Coal, Water and Gasoline Gas Burners for repair purposes.

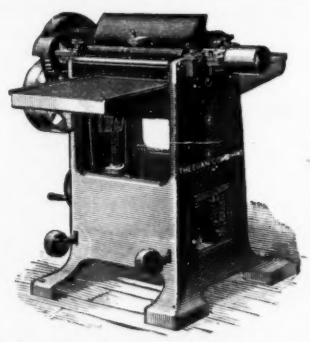
Gasoline and Kerosene Torches, Gasoline Furnaces for plumbers' and tinners' use, Paint Burners, Gasoline Burners, etc.

☞SEND FOR CATALOGUE.☜

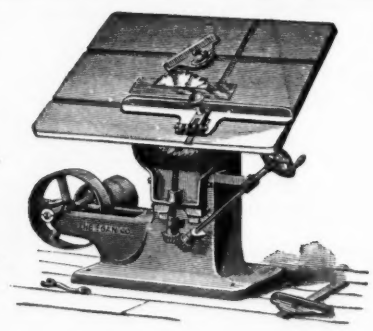
THE SCHNEIDER & TRENKAMP CO., Cleveland, Ohio.



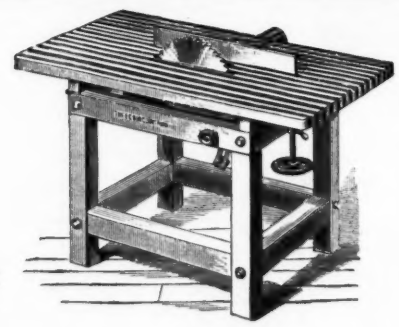
(1) No. 1 Band Saw.



Nos. 1 & 2 Planer and Smoothers.
18 and 24 inches wide.



Variety Saw.



Improved Saw Bench—Six Sizes.

ORICINATORS
— OF —
Time & Labor Saving
MACHINES
— TO —
Reduce Cost
— OF —
Manufacture.

Double End Wood Lathe.
16, 18, 20 and 24-inch Swing, with floor stand.

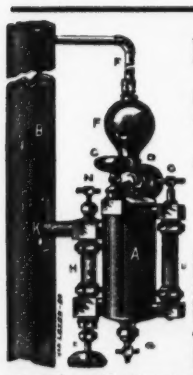
THE EGAN COM'Y,

NOS. 251 TO 271 WEST FRONT ST., CINCINNATI, OHIO, U. S. A.

Builders of the Largest Line of Late Improved **WOOD-WORKING MACHINERY.**

Send for Catalogue and Prices.

All Machines Tested and Tried before Shipping.



— THE —
Detroit - Sight-Feed
LUBRICATORS.
(Gates and Seibert pat's)
Are pronounced the best by more than **40,000 Users.**
Simple in operation and always reliable.
A lubricator sent on 30 days' trial to responsible persons.
"I would not take five times the cost of my Lubricator if I could not get another," is the statement often made by users. Send for circular and price list.
Detroit Lubricator Co.,
164 Griswold Street, Detroit, Mich., U. S. A.

FREIGHT AND PASSENGER
ELEVATORS.
L. S. GRAVES & SON,
Main Office and Works, ROCHESTER, N. Y.
BRANCH OFFICES:
NEW YORK, 92 and 94 Liberty St.; **BOSTON**, 113 Devonshire St.; **St. LOUIS**, 301 Roe Building; **DETROIT**, Hodges Building.
SEND FOR CATALOGUE.

Garvin Machine Co.

UNIVERSAL MILLING MACHINE.

Manufacturers of machinists' and iron workers' tools, lathes, planers, milling machines and drills. Special tools for all kinds of manufacturing to order.

Gear and Rack Cutting, Milling and Index Drilling to Order.

Laight & Canal Sts, NEW YORK.

UNION ELECTROTYPE FOUNDRY
TELEPHONE 2139
829 SHERIFF ST. CLEVELAND, O.

THOS. MEIKLE, Pres't. L. E. HOFFMAN, Sec'y. A. A. PARKER, Treas. D. A. STEWART, Sup't.

Ohio Heating, Plumbing & M'fg. Co.,

MANUFACTURERS AND JOBBERS OF
MALLEABLE AND CAST IRON FITTINGS, BRASS GOODS,
Tools and Supplies. Plumbers, Gas and Steam Fitters.
TELEPHONE 2260. **99 and 101 Water St., CLEVELAND, O.**

NORTHERN MEN

WHO HAVE OBSERVED CAREFULLY THE DRIFT OF IRON INDUSTRIES, AND WHO CONTEMPLATE

Southern Manufacture,

Believing that where the raw material can be produced cheapest, there its varied products may be most profitably put forth, are invited to locate at

AT HARRIMAN, TENN.,

THE NEWEST CITY OF THE NEW SOUTH.

Says Dr. Koenig, Professor of Metallurgy and Mining in the University of Pennsylvania: "In connection with the close proximity of the coal in Walden's Ridge, I do not hesitate to make the assertion that iron can be made here at a greater profit than in Birmingham."

Harriman already has Two Railroads—the Cincinnati Southern and the East Tennessee, Virginia & Georgia—which form a junction there; and more are coming. It has a fine river, the Emory, navigable for freighting the year round; the best drainage and splendid water supply. It is nearly 1,000 ft. above sea-level; its climate is charming; and Coal and Iron Ore fairly touch each other at the City's doors It is

INCOMPARABLY THE BEST LOCATION

For Rolling Mills, for Car Wheel Works, for Machine Shops, for Factories of all kinds, yet secured by Northern Capital in the Southern States.

The most desirable inducements for such to locate there, are offered by

THE EAST TENNESSE LAND COMPANY.

A $250,000 Furnace, and a Magnificent Hotel, are to be erected at once by the Company; 200 buildings are under contract for immediate erection; private enterprise is investing large amounts in various minor industries; and large portions of the admirable city site are reserved for CHEAP HOMES FOR WORKINGMEN.

To be Another Birmingham.

☞For full particulars address the Secretary.

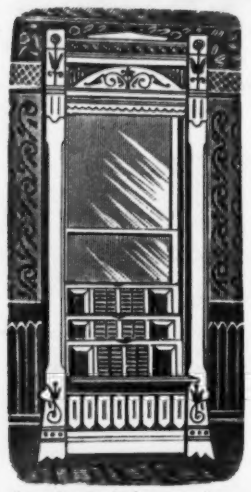
OFFICERS AND DIRECTORS:

CLINTON B. FISK, President. JOHN HOPEWELL, JR., 1st Vice-President. A. W. WAGNALLS, Treasurer. A. A. HOPKINS, Secretary

JAMES B. HOBBS, FERD. SCHUMACHER, WM. SILVERWOOD, WALTER C. HARRIMAN, J. R. LEESON,
E. M. GOODALL, F. W. BREED, FREDERICK GATES, PHILIP S. MASON.

TIMES BUILDING, - - - NEW YORK CITY.

Hartman's Patent Inside Sliding Window Blind



is the most popular Blind in America. Architects & builders prefer it to any other, for **merit, style, convenience** and **economy.**

Not Complicated

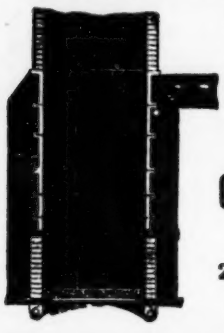
The **Only** Blind that is furnis'd with an automatic **Burglar-Proof Lock,** free of charge. This is an item of **immense magnitude,** and may save you many times the cost of blinds & perhaps life also, and the **only** blind that gives entire satisfaction.

Thousands are in use.

Agents wanted everywhere. Send for illustrated catalogue and prices. Manufactured by

HARTMAN & DURSTINE, No. 59 Beaver St. Wooster, O.

VICTOR COLLIAU,



Sole Manufacturer

OF THE

Improved Patent HOT BLAST Colliau Cupola

ADDRESS:

287 Jefferson Ave. DETROIT, MICH.

JOHN ADT & SON,

New Haven, Conn.,

Builders of Machinery for Hardware Manufacture,

AUTOMATIC

Wire Straightening and Cutting Machines,

Butt Milling Machinery, Butt Drilling Machinery, Riveting Machines, Drilling and Countersinking Machines, Foot Presses, Sprue Cutters, Etc.

INDUSTRY FILE WORKS,

A. & H. Gough, Props.,

Manufacturers of

Files and Rasps,

Equal to the Best English File.

OLD FILES RE-CUT.

All Kinds of Job Grinding.

OFFICE & WORKS,

48 COLUMBUS ST., CLEVELAND, O.

C. GOUGH Manager.

Mention this paper.

SHEPARD'S NEW $60

SCREW CUTTING

Foot Lathe

Foot & Power Lathes. Drill Presses, Scroll Saw Attachm'ts, Mandrels, Chucks, Twist Drills, Dogs, Calipers etc. Lathes on trial Lathes on payment

Send for catalogue of Outfits for Amateurs or Artisans. Address **H. L SHEPARD, Agt.,** 124 East Second St., Cincinnati, O.

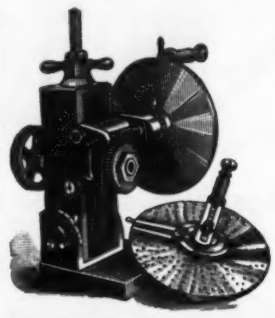
S. T. W. Ejector.

For Raising Water from Deep Wells, Streams, Excavations, &c.

The cheapest made. Send for prices.

JAMES JENKS,

Detroit, Mich.



Palmer's Gear Cutting Attachment

CAN BE USED ON ANY SCREW-CUTTING LATHE FOR

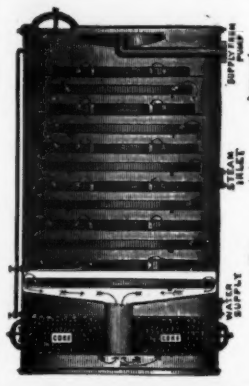
Amateurs, Clock Makers, Model Makers, Knitting Machine Makers, Tool Makers,

Or any one having use for **SMALL GEARING.**

For particulars, address

PALMER, CUNNINGHAM & CO., L't'd,

907 Market St., PHILADELPHIA, PA.



THE MEYER'S ORIGINAL

Live Steam Feed Water Heater,

LIME EXTRACTER AND PURIFIER.

Does away with boiler repairs. Keeps boilers free from scale. All steam users need them.

For information apply to

COX & MORRISON,

Wheeling Boiler Works, Wheeling, W. Va.

G. W. STOCKLY, President. J. J. TRACY, Vice-President. W. F. SWIFT, Secretary.
J. POTTER, Treasurer. N. S. POSSONS, Supt. W. J. POSSONS, Asst. Supt.
S. M. HAMILL, Jr., Assistant Secretary.

THE BRUSH ELECTRIC CO.,

Sole Manufacturers under all the

PATENTS OF CHARLES F. BRUSH, FOR ELECTRIC LIGHTING, STORAGE BATTERIES, CARBONS, ELECTRO-PLATING MACHINES, ELECTRO MOTORS, ETC.

The Brush Light Still Leads the Field.

No other System in the World equals ours in Simplicity, Durability, Earning Capacity, Reliability. The Best is always the Cheapest.
45,000 Brush Arc Lamps now in use. Self-Regulating Incandescent Apparatus.

GET OUR AGENT TO MAKE PLANS FOR YOU BEFORE BUYING ELSEWHERE.

THE BRUSH ELECTRIC CO.,

CLEVELAND, OHIO, U. S. A.

☞Agencies Everywhere.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g. CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE

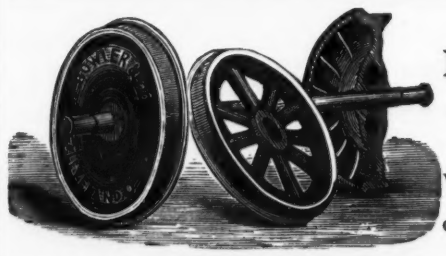
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and cheapest Paint made.

FURNISHED both Dry and Ground in Oil.

USED BY NEARLY ALL THE RAILROADS



CLEVELAND FOUNDRY.

HEAVY CASTINGS.

ARCHITECTURAL WORK in all its branches.

Car Wheels,

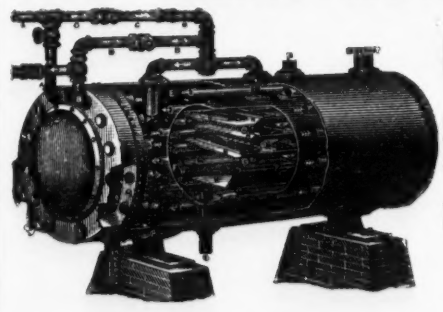
With or without axles, Street Railroad Woeels and Track Supplies.

Office 14 Winter St. CLEVELAND, O. } **BOWLER & CO.**

THE - ARMSTRONG - PURIFIER,

—WITH—

EXHAUST HEATER COMBINED.

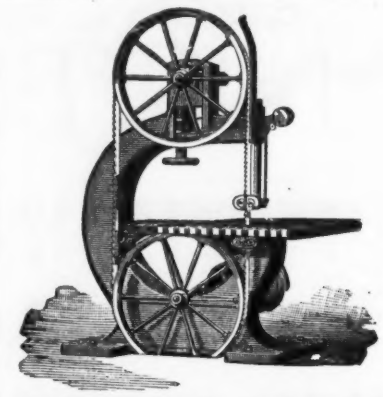


Purifies the feed water by means of the live steam, and heats the water up to the boiling point by means of exhaust steam.

A full description of this heater, together with a valuable treatise on steam boilers, sent to any address free of charge. Address,

Armstrong Bros..

SPRINGFIELD, OHIO.



$80 will buy the best No. 1 band saw in th world.
$100 will buy our new No. 2 40" band saw.
$185 will buy our new patent band re-saw ing machine.
$100 will buy the best No. 1 automatic rip-sawing machine. Weatherboarding attachment included, and one saw.
$125 our new No. 2 complete as above.
For further particulars address

STANDARD MFG. CO.,

110-120 Main St., Mt. Carmel, Ill.

HEADQUARTERS FOR

ANIMAL POKES

They prevent animals from breaching or being injured by barbed wire. Best in the market. Recent valuable improvements. Prices low. Factory extensive and reliable. Send for catalogue and price list.

A. W. BISHOP, Berea, O.

The Goodrich Folding Bath Tub.

Greatest Invention of the Age

Complete in all requirements, is Self-Heating and Folding. When not in use occupies space on floor less than two feet square. Can be used in any ordinary bed-room. For full descriptive circulars and prices address

Mich. Bath Tub Co., Homer, Mich.

A section of our new Steam Pipe Casing complete.

A. WYCKOFF & SON,

Elmira, N. Y.

Patent Steam Pipe Casing

For Underground Steam Pipes

Send for Circular and Prices.

Two staves removed to show the lining between the inside and outside staves.

Steam Jet Pumps,	-	**From $4.00 up.**
Automatic Injectors,	-	" **$5.00 up.**
High Lifting Injectors,		" **$6.00 up.**
Shafting, Hangers,	- -	" **$1.00 up.**

COUPLINGS, BOXES, COLLARS, ETC.

Write for Circulars, Etc.

COLUMBIA INJECTOR CO., CLEVELAND, O.

THE SWEET & CLARK CO., Marion, Ind.

Manufacturers of REFINED AIR FURNACE MALLEABLE IRON.

Superior advantages on account of Natural Gas Fuel. Also manufacturers of Curry-Combs, Hardware and Saddlery Hardware Specialties. ☞Write for Price List and Catalogue.

CLEVELAND ROLLING MILL CO.,

MANUFACTURERS OF

BESSEMER STEEL RAILS,

Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel, Steel Street Rails, Steel O Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.

STEEL WHEELBARROWS FOR Rolling Mills.

GRANT McNEIL, AKRON, O.

Send for barrow circular.

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, four months): Bessemer, $20 50; No. 1 Foundry, $18 80; No. 2 Foundry, $17 80; No. 1 Gray Forge, red short, $16 80; No. 2 Gray Forge, neutral, $16 30; No. 1 American Scotch, $18 80; No. 2 American Scotch, $17 80.

CHICAGO (reported by Messrs. Rogers, Brown & Co.): Southern Coke No. 1. Foundry, $16 50 @17 00; Southern Coke No. 2 Foundry, $16 00 @16 50; Southern Coke No. 3 Foundry, $15 50 @16 00; Southern Coke No 1, Softeners, $16 00 @16 50; Southern Coke No. 2, Softeners, $15 50 @16 00; Ohio Silveries No. 1, $18 50@19 00; Ohio Silveries No. 2, $17 50@ 18 00; Ohio Strong Softeners No. 1, $19 75@20 25; Ohio Strong Softeners No. 2, $18 75@19 25; Lake Superior Charcoal Nos. 1 to 6, $21 50@22 00; Tennessee Charcoal No. 1, $20 50@21 00; Tennessee Charcoal No. 2, $20 00@20 50; Southern Standard Car Wheel, $25 00@25 50; Tennessee Standard Car Wheel, $21 50@22 00; Hanging Rock Standard Car Wheel Cold Blast, $26 00@28 00; Hanging Rock Standard Car Wheel Warm Blast, $23 00@25 00; Old Car Wheels, $00 00@00 00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry (new classification), $15 25@15 75; Southern Coke No. 2 Foundry (new classification), $14 75@ 15 25; Southern Coke No. 3 Foundry (new classification), $14 25@14 75; Grey Forge, $14 75@14 25; White and Mottled, different grades, $13 00@13 50; Silver Grey, different grades, $13 75@14 75; Southern Charcoal No. 1 Foundry, $17 00@18 50; Southern Charcoal No. 1 Mill, $15 75@16 75; Southern Car Wheel, Standard brands, $23 00@24 00; Southern Car Wheel, other brands, $18 50@21 00; Hanging Rock Coke No. 1 Foundry, $16 50@17 50; Hanging Rock Charcoal No. 1 Foundry, $20 50@ 21 50; Hanging Rock Cold Blast, $22 00@24 00; Hanging Rock Warm Blast, $00 00@00 00.

LOUISVILLE (reported by Hall Bros. & Co.): HOT BLAST FOUNDRY—Southern coke No. 1, $16 00@16 25; Southern coke No. 2, $15 00@15 50; Southern coke No. 3, $14 50@15 00; Mahoning Valley (Lake ore mixtures), $18 00@19 00; Southern charcoal, No. 1, $17 50@18 00; Southern charcoal, No. 2, $17 00@17 50; Missouri charcoal, No. 1, $18 50@19 00; Missouri charcoal, No. 2, $18 00@18 50. FORGE—Neutral coke, $14 00@14 50; Cold short, $14 00@15 00; Mottled, $13 50@14 00. CAR WHEEL AND MALLEABLE—Southern (standard brands), $22 50@ 23 00; Southern (other brands), $19 00@20 00; Lake Superior, $22 50@23 00.

ST. LOUIS (reported by Rogers, Meacham & Shields): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $16 25@16 75; Southern Coke No. 2, $15 75@16 2 ; Southern Coke No. 3, $15 25@ 5 75; Southern Grey Forge, $14 75@ 15 25; Southern Charcoal No. 1, $19 50@20 00; Southern Charcoal No. 2, $19 00@19 50; Missouri Charcoal No. 1, $19 00@19 50; Missouri Charcoal No. 2, $18 50@19 00; Ohio Softeners, $19 00@ 20 50. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $23 00@24 00; Southern, $21 00@ 24 00. CONNELLSVILLE COKE—East St. Louis, $5 65; St. Louis, $5 80.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $19 50@20 25; Mahoning and Shenango Valley strong, No. 2 Foundry, $18 50 @19 25; Niagara No. 1, $20 25@00 00; Niagara No. 2, $19 25@00 00; Niagara No. 3, $18 25@00 00; Ohio Softener No. 1, $19 00@19 50; Ohio Softener No. 2, $18 00@18 50; Lake Superior Charcoal, $22 00@00 00; Tennessee Charcoal, $20 50@00 00; Southern Softener No. 1, $17 25@00 00; Southern Softener No. 2, $16 75@00 00; Alabama Car Wheel, $25 00@00 00; Hanging Rock Charcoal, $24 00@24 50.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $21 50@22 50; Lake Superior (coke) Bessemer, $20 00@21 00; Katahdin (Maine charcoal), $26 00 @26 50; Lake Superior Coke, Foundry, all ore, $18 75@19 50; Lake Superior Coke, Foundry Cinder Mixed, $18 00@19 00; Standard Ohio Black Band, $19 00@19 50; Southern No. 1, $17 00@17 50; Southern Gray Forge, $14 75@ 15 25; Jackson County (Ohio) Silvery, $19 00@ 19 50; Old Car Wheel, $20 00@00 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $18 00@18 25; No. 2 Foundry, $16 75@17 00; Grey Forge, $15 75@16 00; White and Mottled, $15 00@15 50; Warm Blast Charcoal, $19 00@22 00; Cold Blast Charcoal $23 00 @29 00; Bessemer, $18 00@18 50.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $15 50@ 6 00; Hanging Rock Coke, No. 1 foundry, $18 00@19 00; Jackson Co. Stone Coal, No. 1 foundry, $17 50@18 50; Tennessee Charcoal, No. 1 foundry, $ 8 50@19 00; Hanging Rock Charcoal, No. 1 foundry, $21 00 @22 00. MILL IRONS—Standard Southern Coke grey forge, $13 75@14 25; Standard Southern Coke, mottled. $13 25@13 75; Cold Short Southern Coke, grey forge, $13 75@14 25; Strong Ohio Neutral Coke, grey forge, $16 00@16 25. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $22 50@23 50; Tennessee Car Wheel, $20 50@21 50; Lake Superior Car Wheel, $22 00@23 00.

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 90
4¼ to 6 by ⅜ to 1 inch	2 00
1¾ to 6 by 1⅛ to 2 inch	2 30
1¾ & 1⅜ by ⅜ to ¼ inch	2 00
1¼ & 1⅜ by ⅜ to ¼ inch	2 10
⅝, ¾ and ⅞ by ⅜ to ⅝ inch	2 30

Round and Square.

1 to 1⅞ inch	1 90
2 to 2⅝ inch	2 10
2¾ to 3¼ inch	2 40
3⅜ to 4 inch	2 90
4⅛ to 4⅝ inch	3 40
4¾ to 5 inch	3 60

Oval.

⅞ to 1¼ inch	2 30
⅝ to ¾ inch	2 50
½	2 70
⅜	3 10

Half Oval and Half Round.

1¼ to 3 inch	3 00
⅞ to 1¼ inch	2 60
⅝ to ¾ inch	3 20
½	3 40
⅜	4 90

Heavy Band.

1½ to 6 by ¼ and 5-16 inch	2 10
1 to 1⅜ by ¼ and 5-16 inch	2 20
¼ to ⅜ by ¼ and 5-16 inch	2 40
⅛ to ⅜ by ¼ and 5-16 inch	2 90

Hoops.

1¼ to 4, Nos. 13 to 15	2 70
1½ to 2, Nos. 16 to 18	2 80
1¼ to 2, No. 19	2 95
1¼ to 2, No. 20	3 00
1¼ to 2, No. 21	3 10
1¼ to 2, No. 22	3 20
15-16, 1 and 1⅛, Nos. 13 to 15	1 90
15-16, 1 and 1⅛, Nos. 16 to 18	3 00
15-16, 1 and 1⅛, Nos. 19 and 20	3 10
15-16, 1 and 1⅛, No. 21	3 20
15-16, 1 and 1⅛, No. 22	3 30
⅞, Nos. 13 to 15	3 10
⅞, Nos. 16 to 18	3 20
⅞, Nos. 19 and 20	3 30
⅞, No. 21	3 40
⅞, No. 22	3 50
13-16, Nos. 13 to 15	3 30
13-16, Nos. 16 to 18	3 40
13-16, Nos. 19 and 20	3 50
13-16, No. 21	3 60
13-16, No. 22	3 70
¾, Nos. 13 to 15	3 40
¾, Nos. 16 to 18	3 60
¾, Nos. 19 and 20	3 70
¾, No. 21	3 80
¾, No. 22	3 90
11-16, Nos. 13 to 15	3 60
11-16, Nos. 16 to 18	3 80
11-16, Nos. 19 and 20	3 90
11-16, No. 21	4 00
11-16, No. 22	4 10
⅝, Nos. 13 to 15	3 90
⅝, Nos. 16 to 18	4 10
⅝, Nos. 19 and 20	4 20
⅝, No. 21	4 30
⅝, No. 22	4 40
⅝, No. 23	4 50

Light Band.

1½ to 6 by ⅛ to 3-16 in	2 30
1½ to 6 by Nos. 11 and 12	2 40
1 to 1⅜ by ⅛ to 3-16 in	2 50
1 to 1⅜ by Nos. 11 and 12	2 60
⅞ and 13-16 by ⅛ to 3-16 in	2 80
⅞ and 13-16 by Nos. 11 and 12	2 90
¾ and 11-16 by ⅛ to 3-16 in	3 10
¾ and 11-16 by Nos. 11 and 12	3 20
⅝ and 9-16 by ⅛ to 3-16 in.	3 40
⅝ and 9-16 by Nos. 11 and 12	3 50
½ by ⅛ to 3-16 in	3 70
½ by Nos. 11 and 12	3 80

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	2 90
⅜ inch, " " " 13 and 14	3 10
¼ inch, " " " 11 and 12	3 20
¼ inch, " " " 13 and 14	3 40

Sheet Iron.

No. 10 to 14	2 65
No. 15 to 17	2 80
No. 18 to 21	3 00
No. 22 to 24	3 20
No. 25 to 26	3 35
No. 27	3 45
No. 28	3 55

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 80
C No. 1, " "	3 05
C H No. 1 " "	3 30
C H Flange, " "	4 05
Extra Flange, "	4 55
Solid Fire Box "	5 30

Steel Boiler Plates—1-4 in. and Heavier.

Tank	3 00
Shell	3 40
Flange	3 70
Marine Flange	4 10
Fire Box	4 80

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c ℔ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1⅛c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s
1 to 2 in. inclusive	09
9-16 to ½ in "	09
7-16 to ⅜ and 2⅜ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. ℔s
2 to 9-16 wide by 2 to ⅛ thick	9

Bessemer and O. H. Steel.

Machinery	base price,	3 00
Tire	"	3 00
Spring	"	3 50
Sleigh Shoe	"	3 00
Toe Calk	"	3 25
Cutter Shoes, tapered and burr.	"	3 25

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

⅛, 5/16, 11-16 and ¾ inches diameter	4 00
Bridge ⅛, 5/16, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

	NET TONS
No. 1 R. R. wrought scrap	$19 00
No. 1 wrought scrap	18 00
No. 1 Machine cast scrap	14 00
Iron axles	24 00
Axle turnings	15 00
Wrought turning (free from cast)	13 00
Cast borings	9 00
Uncut wrought iron boilers	13 00
Steel boiler plates	17 00
Grate Bars	9 00
Pipes and flues (Clean)	14 00
Tank iron	14 00
Hoop and band iron	12 00
Sheet iron	10 00
Wrought drillings	12 00
Malleable iron	10 00
	GROSS TONS
Old iron T rails	24 00
Old steel rails	21 00
Old car wheels	18 50
Old copper	⅞ ℔ 10
No. 1 H. red Brass	11
Heavy yellow brass	8½
Light yellow brass	6
Scrap Zinc	
Tea Lead	
Heavy Lead	3¼

H. N. HILL & CO.

Manufacturers' Agents' for

BOILER TUBES.
PLATE STEEL.
BOILER RIVETS.
NORWAY IRON RIVETS.
SMOKE STACK AND GASOMETER RIVETS.
BAR IRON.
BAR STEEL.
STEEL AND IRON ANGLES.
SHEET IRON.
SHEET STEEL.
RAILROAD AND BOAT SPIKES.
WROUGHT IRON PIPE AND FITTINGS.
PULLEYS, HANGERS AND COUPLINGS.
BEAMS AND CHANNELS.
STEEL RAILS AND CASTINGS.
GALVANIZED SHEET.
PORTABLE FORGES.
RAILROAD AND MACHISTS' SUPPLIES.

813 PERRY-PAYNE BUILDING,

Telephone 95. CLEVELAND, O.

PITTSBURGH & WHEELING COAL CO.,

MINERS AND SHIPPERS OF

Ohio Steam Coal and Coke.

Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.

Office, 29 Mercantile Bank Building, CLEVELAND, OHIO

Lake Shipping Point, Lorain O.

IAS. PATTERSON, Sales Agent

DALLIBA, CORRIGAN & CO.,

DEALERS IN

Iron Ore & Pig Iron,

Rooms 716, 717, 718, 719 Perry-Payne Bld'g, CLEVELAND, O.

TUTTLE, OGLEBAY & CO.,

Commission Dealers in

Iron - Ores.

FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS, CLEVELAND, OHIO.

J. H. OUTHWAITE. W. G. POLLOCK.

J. H. OUTHWAITE & CO.,

Exclusive attention given to LAKE SUPERIOR AND MENOMINEE RANGE

Iron Ore.

Perry-Payne B'ld'g, . Cleveland, O.

THE CONDIT-FULLER CO.,

Pig and Bar Iron,

CLEVELAND, OHIO.

Pickands, Mather & Co.,

IRON ORE - -

—AND—

- - PIG IRON

Corner Bank and Superior Streets, CLEVELAND, O.

E. C. POPE,

COMMISSION DEALER IN

Iron Ore, Pig Iron

AND METALS.

Cleveland, - Ohio.

Hoisting Engines OF ALL SIZES.

Address,

JOHN F. BYERS, RAVENNA, O,

FOREST CITY Machine Works.

Wrought Iron Chaplets and Chaplet Stems.

LARGE HEAD RIVETS for stacks, Gasometers, Etc.

Works: 40, 42 and 44 Columbus St., and 37 Winter St., CLEVELAND, OHIO.

MANUFACTURERS OF

INDIANA MACHINE WORKS

FORT WAYNE INDIANA

BUILDERS OF WOOD WORKING MACHINERY.

WRITE FOR DESCRIPTIVE CIRCULARS

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 9¼

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70@70& 5
" " " extra.....dis 60&5@60&10
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard.dis 60&10
Shultz Raw Hide Leather Belting, single, ...dis 40
Shultz Raw Hide Leather Belting, double, and Light Double.....dis 40
Standard, oak tanned.....dis 55@60
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 9¾@10¼

Chalk.

White .....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 30
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Skinner " .....dis 40
" Independent.....dis 40
Almond Drill.....dis 25
Morse " .....dis 15
Skinner " .....dis 30

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3¼

Drill and Drill Stocks.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¼".....dis 50&10
Morse Taper and Straight shank Larger than 1¼".....dis 25
Drill Sockets.....dis 25
Standard.....dis 50&10
Cleveland.....dis 50&10

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2¾c
½ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 40@46
H. H. Barton.....dis 40@46

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Union Stone.....dis 60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3¾	3⅜
Hexagon	15⅝	11¼	8⅝	6	5¾	5¼	5
Washers	9	8	7	5	4⅝	4⅛	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 70@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 60
Sheet Rubber.....₩ lb 13@24
Excelsior Rubber.....₩ lb 24

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ½ inch and over.....₩ lb 15¼
Sisal, ½ inch and over .....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis 40@40&10
H. H. Barton's.....dis 40@40&10
New England Flint.....dis 40@40&10
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 45
" Band.....dis 20
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 20
Atkins' Cicular Saws.....dis 50
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay .....dis 45

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron.....dis 50
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 55
Machine, round head, iron.....dis 50
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine)	11½c	
3-Ply " 1 lb Balls	12@12¼c	
3-Ply " 1½ lb Balls	11@11¼c	

Cotton Wrapping, 5 Balls to lb.....15@16c

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 10@15
Howard.....dis 30
Maneer's machinist.....dis 50&10

Wire.

New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00@lb dis 30

Wrenches.

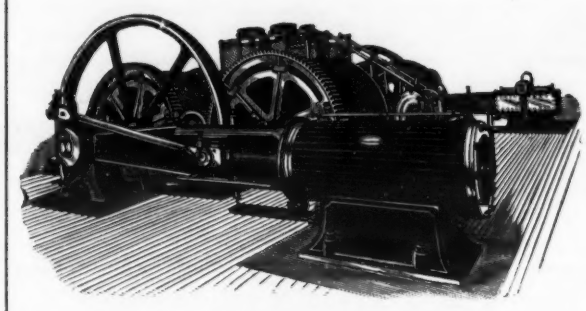
Coe's genuine, cash in ten days.....dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 10
William's " " .....dis 10
Alligator " " .....dis 40

Improved Screw Cutting FOOT AND POWER **LATHES**

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

THE SEBASTIAN-MAY CO.,
164 West Second St., CINCINNATI. O.

Webster, Camp & Lane Machine Co.



MANUFACTURERS OF

Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

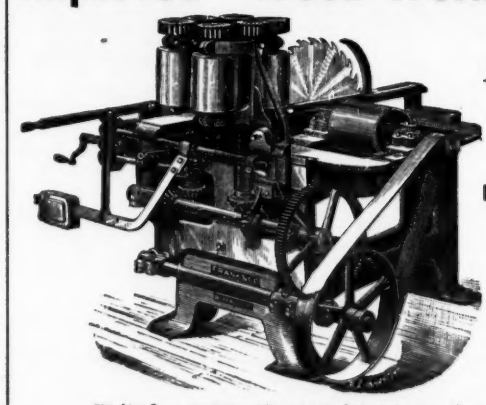
CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves. Cages, Buckets, Etc.

Send for Catalogue D. 134 N. Main St., AKRON, OHIO.

THE THOS. D. WEST FOUNDRY, CO.
CLEVELAND, O.
LIGHT AND HEAVY
IRON CASTINGS.
DAILY MELTING CAPACITY 75 TONS-SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.
DUPLICATE WORK A SPECIALTY

Improved Wood-Working Machinery.



A FULL LINE

LOW PRICES.

Planing, Matching, Molding, Tenoning, Mortising, Boring, Shaping, Carving, Etc.

Complete Outfits.

Write for our New Illustrated Catalogue (just out) and our Latest Price List. Mention this paper.

FRANK & CO., 176 Terrace Street, BUFFALO, N. Y.

Lubricator for Traction, Portable and all other small engines, pumps, &c. Single Connection.

IMPROVED
Unique Automatic Steam Sight-Feed
LUBRICATORS.

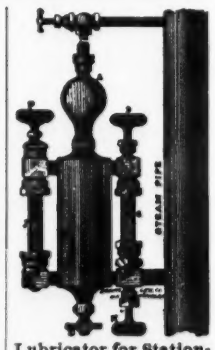
Indorsed by Leading Engine Builders.

Manufactured under strong patents, the validity of which is acknowledged.

For Illustrated Pamphlet and Price List fully describing above, address

UNIQUE LUBRICATOR CO.,
Mansfield, Ohio.

Active Agents Wanted. Special inducements offered Dealers and Jobbers.



Lubricator for Stationary Engines. Double Cnonection.

JUSTICE HAMMER.

Williams, White & CO.,
Moline, Illinois,
MANUFACTURERS OF
DROP PRESSES,
The Forging and Bending Machine,
The Bulldozer
DOUBLE AND SINGLE
Punch and Shears,
THE IMPROVED
Justice Spring Hammer.

STEEL CASTINGS

FROM 1-4 TO 15,000 LBS. WEIGHT.
True to pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position, or for any service whatever.
60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.
Crossheads, Rockers, Piston-Heads, etc., for Locomotives. STEEL CASTINGS of every description.
Send for cirulars and prices to
Chester Steel Castings Co.,
WORKS: CHESTER, PA. OFFICE 407 LIBRARY ST., PHILADELPHIA, PA

OIL ALWAYS BELOW BURNERS---BY USING OUR SYSTEM.
OUR SYSTEM IS INSURABLE IN ALL INSURANCE COMPANIES.
WE GUARANTEE INSURANCE WHEN PLANT IS INSTALLED ACCORDING TO OUR SPECIFICATIONS.

THE AERATED FUEL CO.,

425 MAIN STREET, SPRINGFIELD, MASS.
FORGING, WELDING, BRAZING, MELTING, ANNEALING, HARDENING, TEMPERING.
THE GILBERT & BARKER MFG. CO., Springfield, New York and Boston, General Agents for U. S.

Represented by { W. S. COLLINS, 171 BROADWAY (SUITE 24), NEW YORK. / WM. PICKETT, SON & CO., 170 LAKE ST. CHICAGO, ILL. / KALAMAZOO SPRING & AXLE CO., KALAMAZOO, MICH. / CHILION JONES, GANANOQUE, ONTARIO. / G. M. SMITH, LOS ANGELES, CAL. / C. S. BARROWS, 6 WADE BLDG., CLEVELAND, O.

☞SEND FOR CATALOGUES.☜

HARDWARE MARKET.

Augers and Bits.

ommon augers and bits.....dis 70
nell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $8 00
Others.....℔ doz $7 00
Full polished.....℔ doz $9 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 70&12½
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 62½
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70
Loose joint, jap.....dis 70
Loose joint, jap. with acorns.....dis 70
Loose pin, acorns.....dis 70
Loose pin, japanned acorns.....dis 70
Loose pin, acorns, jap. plated tips.....dis 70
Wrought steel—
Wrought, fast joint, narrow.....dis 70
Wrought, fast joint, broad.....dis 70
Wrought, loose joint, broad.....dis 70
Table Butts, back flaps, etc.....dis 70
Regular inside blind.....dis 70
Light inside blind.....dis 70
Loose pin.....dis 70
Light loose pin.....dis 70

Chains.

Trace, 6½-10-2.....℔ pair 1.03
Trace, 6½-10-3.....℔ pair .92 } 50&10@50&10&5
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....℔ 05½@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 70&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber, Slop, Commode } 5 and 5X 14 qt.	6 50	7 50	8 50
Jars, slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11½ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hangers.

Barn door, old patterns.....dis 10&10@70
Climax, (Anti-Friction).....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ M	23	24	25	26	28	dis 25&10@25&10&10
Putnam, ℔ M	18	19	20	21	23	dis 15
Essex						dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs. genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze....dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@00
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods dis 70&5@70&10&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 65&5
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@⅄...dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ dox $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Dr vers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron, Nickel plated.....dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

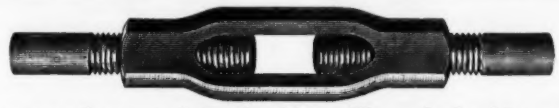
New List, January 2, 1888.
American iron carpet tacks all kinds dis 70&5
Steel carpet tacks all kinds.....dis 70&5
Swedes iron carpet tacks, all kinds.....dis 70&5
Swedes iron tacks.....dis 70&5
Swedes iron Upholsterers' tacks.....dis 70&5
Tinned Swedes iron tacks.....dis 70&5
Tinned Swedes iron Upholsterers' tacks.....dis 70&10
American iron cut tacks.....dis 67½&5
Copper tacks.....dis 50
Copper finishing and trunk nails.....dis 50&00
Cigar box nails.....dis 45&10
Finishing nails.....dis 65
Hungarian nails and miners' tacks.dis 62½&5
Gimp and lace tacks.....dis 70&5
" " " tinned.....dis 66&10
Trunk and clout nails.....dis 66⅔
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10
Tinned capped trunk nails.....dis 60

AULT & WIBORG
PRINTING INKS.
CINCINNATI.
A&W INK USED ON THIS PUBLICATION

New Kodak Cameras.

"You press the button we do the rest."
(OR YOU CAN DO IT YOURSELF.)
Seven New Styles and Sizes
ALL LOADED WITH
Transparent Films.
☞For sale by all Photo. Stock Dealers. *Send for Catalogue.*
THE EASTMAN COMPANY, Rochester, N. Y.

TURNBUCKLES.



Wrought iron open hexagonal turnbuckles. The only buckle made that has a perfect wrench hold.

Made from charcoal iron.
THE CENTRAL IRON & STEEL COMPANY,
BRAZIL, IND.
☞Sole Manufacturer.

B. BARRETT'S SONS & CO.,
MANUFACTURERS OF THE
Barrett-Laughlin Car Box Steel Axles and Chilled Wheels
FOR
Coal, Mining and Quarry CARS.
THE BARRETT-LAUGHLIN CAR BOX
Patented Dec. 6, 1887.

☞Send for Descriptive Circular and Price List. WOOSTER, OHIO.

THE W. BINGHAM HARDWARE CO.,
146, 148 AND 150 WATER STREET,
CLEVELAND, OHIO.
HARDWARE, IRON, NAILS AND METALS
OF EVERY DESCRIPTION
Railway, Machinists' and Miners' Supplies.
WILLIAM JESSOP & SONS AND PETER STUBS' CELEBRATED CAST STEEL
MALLEABLE AND CAST GAS AND WATER FITTINGS.
Nathan & Dreyfus' Self-Acting Oilers and Lubricators, Injectors and Ejectors; Pennsylvania Tube Works Pipe and Boiler Flues; Peet's Open Way Valves; Boston Belting Co.'s Rubber Belting, Packing and Hose; Alexander Bros.'s Leather Belts.
STUBS, GROBET & ROTHERY FILES, ETC., ETC

Hulet, Holmes & Co.
MANUFACTURERS OF THE CELEBRATED
Eclipse Folding Clothes Bars,
The latest and best Clothes Bars on the market. Also manufacturers of Pick Handles from Second Growth Hickory. These Pick Handles are made all sizes, and for beauty of finish cannot be excelled. Write for circular and price list.
HULET, HOLMES & CO.,
BEREA, OHIO.

Classified List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks.

PAGE.

Aluminum—
Cowles Electric Smelting & Aluminum Co., Cleveland 12
Animal Pokes—
A. W. Bishop, Berea, O 16
Bath Tubs—
*Michigan Bath Tub Co., Homer, Mich 16
‡Instantanous Water Heating Co., Chicago, Ill ..... —
Day Mfg. Co., Detroit, Mich 12
Blowers—
Buffalo Forge Co., Buffalo, N. Y 23
Boring Machines—
*J. H. Osborne & Co., Union City, Ind ..... —
Bolts and Bolt Machinery—
Upson Nut Co., Cleveland 20
Beltings—
Akron Belting Co., Akron, O 23
Belt Holders—
*W. R. Santley & Co., Wellington, O 20
Boilers and Boiler Attachments—
J. C. McNeil & Co., Akron, O 20
Enterprise Boiler Co., Youngstown, O 20
Unique Lubricator Co., Mansfield, O 18
Columbia Injector Co., Cleveland 16
Penberthy Injector Co., Detroit, Mich 24
Detroit Lubricator Co., Detroit, Mich 14
Wm. B. Pollock & Co., Youngstown, O 22
Alliance Steam Boiler Works, Alliance, O 20
Bolt Cutters—
H. B. Brown & Co., East Hampton, Ct 21
Bicycles—
Lozier & Yost, Toledo, O 19
Cameras—
Eastman Co., Rochester, N. Y 20
Car Axles—
B. Barrett's Sons & Co., Wooster, O 15
Chaplets—
Forest City Machine Works, Cleveland ... 17
Coal and Coke—
Pittsburgh & Wheeling Coal Co., Cleveland 17
ranes and Derricks—
Wm. Tod & Co., Youngstown, O 22
Harmar Foundry & Machine Co., Harmar, O 22
Car Wheels—
Bowler & Co., Cleveland 16
Clothes Bars—
Hulet, Holmes & Co., Berea, O 19
Damper Regulators—
*Curtis Regulator Co., Boston, Mass ..... —
Die Makers.
Avery Stamping Co., Cleveland 13
Door Hangers—
Taylor and Boggis Fdy. Co., Cleveland 24
Drilling Machines—
Universal Radial Drill Co., Cincinnati, O.. 16
*Lodge, & Davis Machine Tool Co., Cincinnati, O ..... —
W. F. & John Barnes' Co., Rockford, Ills.. 13
Drop Presses—
Williams, White & Co., Moline, Ill 18
Dry Kilns—
*Akron Heating & Ventilating Co., Akron, O ..... —
Engineers and Contractors—
E. H. Jones & Co., Cleveland 22
Elevators—
L. S. Graves & Co., Rochester, N. Y 14
Explosives—
Hercules Powder Co., Cleveland 13
Electrical Manufactures—
†Cleveland Electrical Mfg. Co., Cleveland —
Brush Electric Co., Cleveland 16
Elevator Buckets.
Avery Stamping Co., Cleveland 13
Emery Wheel Dressers—
W. W. Brisben, Cleveland 22
Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill 24
W. F. & John Barnes' Co., Rockford, Ill... 13
Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland 24
Union Electrotype Foundry, Cleveland.... 14
Engines (Steam)
Kilby Manufacturing Co., Cleveland 24
E. H. Jones & Co., Cleveland 22
*Chandler & Taylor Co., Indianapolis, Ind. —
The Westinghouse Machine Co., Pittsburgh, Pa 22
Geo. Worthington Co., Cleveland 22
Cleveland & Hardwick, Erie, Pa 22
Jas. Leffel & Co., Springfield, O 22
Wm Tod & Co., Youngstown, O 22
Skinner Engine Co., Erie, Pa 22
Aetna Machine Co., Warren, O 22
Engines (Gas)—
Schleicher, Schumm & Co., Philadelphia, Pa. and Chicago, Ill 22
Van Duzen Gas Engine Co., Cincinnati, O 22
Engines (Hoisting)—
John F. Byers, Ravenna, O 17
Engineers' Specialties—
Crescent Manufacturing Co., Cleveland... 12
*Curtis Regulator Co., Boston, Mass ..... —
Standard Regulator Co., Buffalo, N. Y 23
Ejectors—
ames Jenks, Detroit, Mich 16
Flue Cleaners—
Crescent Manufacturing Co., Cleveland 12
Fibre-Ware—
Standard Fibre-Ware Co., Mankato, Minn 12
For Sale—
Foundries, Furnaces, Machinery, etc 20
Files, Makers of—
Reynolds Bros., Columbus, O 20
A. & H. Gough, Cleveland 12
Forges—
Buffalo Forge Co., Buffalo, N. Y 19
Cleveland City Forge & Iron Co., Cleveland 19
Foundries—
Bowler & Co., Cleveland ..... 16 & 20
Curry & Co., Meadville, Pa 20
Thos. D. West. Foundry Co., Cleveland 19
Feed Water Heaters—
Stilwell & Bierce Manufacturing Co., Dayton, O 20
Laidlaw & Dunn Co., Cincinnati, O 18
Armstrong Bros., Springfield, O 12
E. H. Jones & Co., Cleveland 18
Cox & Morrison, Wheeling, W. Va 12
Foundry Cupolas—
Victor Colliau, Detroit, Mich 12
Frost Proof Steam Traps—
*Curtis Regulator Co., Boston, Mass ..... —
Galvanizers.
Avery Stamping Co., Cleveland 13
Gas and Gasoline Stoves—
Schneider & Trenkamp Co., Cleveland 14
Gas Machines—
Detroit Heating & Lighting Co., Detroit, Mich 11
Gear Cutters—
Palmer, Cunningham & Co., Philadelphia, Pa 16
Hardware—
W. Bingham Hardware Co., Cleveland..20 & 19
Geo. Worthington Co., Cleveland 22
Bronson Supply Co., Cleveland 24
Hose—
Fabric Fire Hose Co., New York 11
Hot Air Furnaces—
Beecheer Furnace Co., Cleveland 21
Iron and Steel Roofing—
Sykes Iron Roofing Co., Niles, O 23
Cambridge Iron Roofing Co., Cambridge, Ohio 23
Garry Iron Roofing Co., Cleveland 23
Standard Iron Co., Bridgeport, O 23
Thompson Manufacturing Co., Cleveland, 23
W. G. Hyndman & Co., Cincinnati, O 23
W. J. Burton & Co., Detroit, Mich 23
Kanneberg Roofing Co., Canton, O 23
Berger Mfg. Co., Canton, O 23
Holton Iron Roofing Co., New Lisbon, O 23
*Merchant & Co., Philadelphia Pa 13
Iron (Malleable)—
Sweet & Clark Co., Marion, Ind 17
Iron Ore, Bar and Pig Iron—
Dalliba, Corrigan & Co., Cleveland 17
Tuttle, Oglebay & Co., Cleveland 17
J. H. Outhwaite & Co., Cleveland 17
Condit-Fuller Co., Cleveland, O 17
Pickands, Mather & Co., Cleveland....16 & 17
H. N. Hill & Co., Cleveland 17
E. C. Pope, Cleveland 17
Illuminating Apparatus—
Wheelock & Crichton, Chicago, Ill 13
Lath Mills—
D. S. Abbott, Olean, N. Y 21
Lathes—
Sebastian, May & Co., Cincinnati, O 18
H. L. Shepard, Cincinnati, O 16
*Lodge, & Davis Machine Tool Co., Cincinnati, O 24
Lifting Jacks—
F. M. De Weese, Chillicothe, O 21
Mantels, Grates, Etc.—
Conger & Collins Mantel Co., Cleveland... 24
Manufacturing Sites—
Chas. G. Eddy, Roanoke, Va 9
*Muncie Natural Gas Land Improvement Co., Muncie, Ind 11
East Tennessee Land Co., New York 15
Mining Machinery—
Webster, Camp & Lane Machine Co., Akron, O 18
*Copeland & Bacou, New York 12
Machinery (Foot Power)
W. F. & John Barnes' Co., Rockford. Ill... 13
Machine Shops—
Webster, Camp, & Lane Machine Co., Akron, O 20
Machinists' Tools and Supplies—
Parkin & Bosworth, Cleveland ..... 20 & 24
Garvin Machine Co., New York 14
Office Furniture—
Burgess & Fish, Cleveland 21
Oil Fuel Process—
Aerated Fuel Co., Springfield Mass 19
Patents—
Osborne & Co., Cleveland 12
*Thos. P. Simpson, Washington, D. C ..... —
Wm. M. Monroe, Cleveland 20
Plumbers and Steam Fitters—
Ohio Heating, Plumbing & Mnfg. Co., Cleveland 14
Pumps (Steam)—
E. H. Jones & Co., Cleveland 22
Laidlaw & Dunn Co., Cincinnati, O 22
Hamar Foundry & Machine Co., Hamar, O 22
Rumsey & Co., Seneca Falls, N. Y 13
Van Duzen & Tift, Cincinnati, O 21
Pipe Coverings—
A. Wyckoff & Son, Elmira, N. Y 16
Planers—
Parkin & Bosworth, Cleveland 24
Pulleys—
Geo. Worthington Co., Cleveland 22
Post Hole Augers—
*J. H. Osborne & Co., Union City, Ind ..... |
Printing Inks—
Ault & Wiborg, Cincinnati, O 19
Punching and Shearing Machine—
Williams, White & Co., Moline, Ill 18
Paint—
Iron Clad Paint Co., Cleveland, O 16
Nubian Iron Enamel Co., Chicago, Ill 11
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill 13
Rolled Steel—
Wilmot & Hobbs Mfg. Co., Bridgeport, Conn 24
Railroads—
Time Tables, Etc 21
Railway Supplies—
Bowler & Co., Cleveland 16
Cleveland City Forge & Iron Co., Cleveland 23
Rivets—
Forest City Machine Works, Cleveland 17
Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland 17
Steam Heating Apparatus—
*Curtis Regulator Co., Boston, Mass ..... —
Detroit Heating & Lighting Co., Detroit, Mich 11
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn 12
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland 20
F. A. Sackman, Cleveland, O 12
Saws—
Detroit Saw Works, Detroit, Mich 13
Peter Gerlach & Co., Cleveland 21
Shapers—
*Lodge & Davis Machine Tool Co., Cincinnati, O ..... —
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland 17
Sheet Steel—
Standard Iron Co., Bridgeport, O 23
Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa 18
Stampers of Sheet Metal—
Avery Stamping Co., Cleveland 13
Tinning Steel, Etc.
Avery Stamping Co., Cleveland 13
Twist Drills—
Cleveland Twist Drill Co., Cleveland 24
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland 23
Central Iron & Steel Co., Brazil, Ind 23
Tackle Blocks—
Fulton Iron & Engine Works, Detroit, Mich 24
Type Founders—
Franklin Type Foundry, Cincinnati, O ... 21
Wheelbarrows and Trucks—
Grant McNeil, Akron, O 17
Lansing Wheelbarrow Co., Lansing, Mich 13
Window Blinds—
Hartman & Durstine, Wooster, O 16
Wire Goods—
*F. Powell & Co., Toledo, O 20
Wire Machinery—
John Adt & Son, New Haven, Conn 16
Wood-Working Machinery—
D. S. Abbot, Olean, N. Y 21
Frank & Co., Buffalo, N. Y 18
Standard Mfg. Co., Mt. Carmel, Ill 16
Indiana Machine Work, Ft. Wayne, Ind 17, 20
Egan & Co., Cincinnati, O 14

For Sale.

ONE OF DUNN'S HOISTING MACHINES, with over 40 feet of chain. Good as new; capacity, 600 lbs. Address Dunn, care Iron Trade Review, Cleveland, O.

PLANER.

A 30x36x10 FOOT BED, BEMENT, in excellent condition; a 20x10 Pond Lathe, eight others, second Hand; No. 4 Garb Milling Machine. A variety of other tools. Write for list.

W. S. AMMON,
13 South Front St., READING, PA.

Factories Wanted

At **East Chattanooga**, adjoining **CHATTANOOGA, Tenn.**, the Hub of the South, and the center of the coal and iron industry. Population in 1880, 13,000; 1885, 25,000; 1889, 55,000. Cheap iron, coal, wood and labor. Low taxes. River front. Nine railroads, more building, giving cheap railroad and water transportation in all directions. Climate, water supply and drainage unsurpassed. Free sites and other inducements to manufacturers.

For full particulars, address **EAST CHATTANOOGA LAND CO.**, Chattanooga, Tenn., or L. B. RUSSELL, Secretary, 95 Summer St., Boston, Mass.

PATENTS

WM. M. MONROE,
SOLICITOR & COUNSELLOR, City Hall, Room 48.

CLEVELAND BUSINESS DIRECTORY.

Bolt and Nut Works.

THE UPSON NUT CO, Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Coal, Iron and Ore.

PICKANDS, MATHER & CO., Iron Ore and Pig Iron, Cor. Bank and Superior Sts.

Foundries.

BOWLER & CO., Car Wheels, Patent Chilled Frogs, and all kinds of casting. 9 Winter.

Hardware and Iron.

WM. BINGHAM HARDWARE CO., THE, Hardware, Iron, Nails and Metals, 148 and 150 Water St.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire.

Hardwood Lumber.

MARTIN & BARRISS, dealers in all kinds of Hardwood Lumber. 130 Central Way.

Machinists' Supplies.

PARKIN & BOSWORTH, 9 and 11 So. Water St., dealers in Manufacturers' Supplies, Machinery and Tools.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

BUSINESS DIRECTORY.

Akron, O.

MCNEIL, J. C. CO., Steam Boilers, Heavy Sheet Iron Work, &c. Repairing promptly executed.

WEBSTER, CAMP & LANE MACHINE CO., Founders and Machinists, 12 Main st.

Alliance, O.

ALLIANCE STEAM BOILER WOKS, Wm. Murphy, Prop'r, manufacturer of all kinds of Steam Boilers.

Meadville, Pa.

CURRY & CO., general jobbers in Castings of all kinds.

Youngstown, O.

ENTERPRISE BOILER CO., Steam Boilers, Stacks, Sheet Iron and Plate Work, Oil and Water Tanks.

Indiana Machine Works,

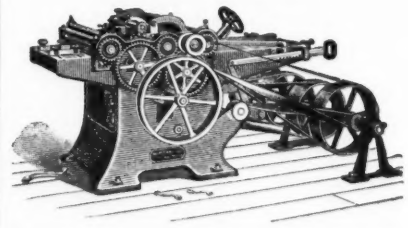
FORT WAYNE, IND.,

Builders of

High Grade

WOOD-WORKING MACHINERY

Of Modern Design.



CLIPPER, PLANER, MATCHER AND MOULDER.

Machinery for

PLANING MILLS,
SASH AND DOOR,
FURNITURE FACTORIES, Etc.

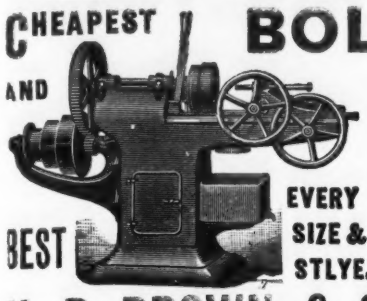
Also make a specialty of light Gray Iron Castings and Mill Supplies.

Prices and Circulars Cheerfully Furnished.

Once more we say LITTLE GIANT.
Then we say UTILE DULCI.
Now we ask you why you should place your orders early for the LITTLE GIANT. So as to secure what you want, just when you want it. We know from experience, that everybody wants the best. We are prepared to furnish it at a moderate price. It becomes a pleasure to supply the public with what they want, when you know from experience, that your goods will please them.
The LITTLE GIANT will bear the closest of criticism, therefore we extend an invitation to all to examine it for themselves. Price $35.00. It is needless to add, constructed of modern improvements.

LOZIER & YOST B. MFG. CO., Toledo, Ohio.

CHEAPEST AND BEST



BOLT CUTTERS. EVERY SIZE & STLYE.

H. B. BROWN & CO.,

EAST HAMPTON, CT.

We allow One Dollar to every purchaser sending us this advertisement.

Seeger & Guernsey's Cyclopædia of

THE MANUFACTURES AND PRODUCTS OF THE UNITED STATES,

comprises Every Article made in this Country—Indexed and Classified—and under each article the names and addresses of

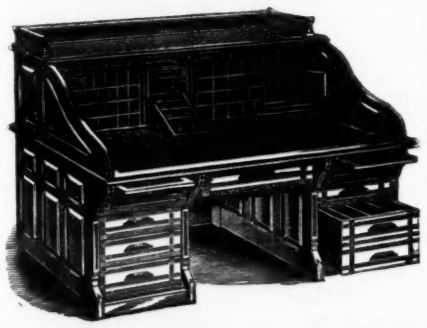
THE BEST MANUFACTURERS.

Complete in One Royal Octavo Vol. of over 1000 pp. Price in Cloth, $5. in Leather, $7.

INDISPENSABLE

to Buyers of Articles in all lines and Invaluable as a Statistical work.

Orders received at office of this Paper



BURGESS & FISH,

Successors to BURGESS BROS.,

DESKS, CHAIRS, DOCUMENT FILES, LETTER FILES, OFFICE SPECIALTIES.

Repairing and Cleaning a Specialty.

213 Bank St., CLEVELAND, O.

TELEPHONE 2329.

FRANKLIN TYPE

And ELECTROTYPE FOUNDRY,

168 VINE STREET, CINCINNATI, OHIO.

The type on which this paper is printed is from the above foundry.—ED. REVIEW.

VAN DUZEN'S STEAM JET PUMP

For MILLS, FACTORIES, SHOPS, ETC.

For Elevating and Conveying Liquids. For Emptying Pits, Sinks, Cesspools, etc., and as a Fire Pump.

10 Sizes. $7 to $75. Every Pump warranted.

Write for Descriptive Pump Circular H

VAN DUZEN & TIFT, CINCINNATI, O.

FOR THE BEST AND LOWEST PRICED GANG LATH MILL AND BOLTER COMBINED.

ADDRESS D. S. ABBOTT, OLEAN, N.Y.

Please mention this paper.

TRAVELERS' REGISTER.

Standard Time.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	†1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m.,6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 45 a m	*6 25 p m
Marietta Express.....	†11 15 a m	†2 25 p m
Valley Junction Express...	*4 15 p m	*10 25 a m
Cleve. and Canton Express	*7 05 p m	†8 20 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	8 00 a m	d5 25 a m
	1 05 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	8 00 a m	12 50 p m
	1 05 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.	3 25 p m	9 40 a m
Ravenna Accom.....	5 00 p m	8 25 a m

d Daily. *Except Saturday. Other trains except Sunday.

From Cleveland Union Station.

Mt. Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus Xenia, Dayton, Cincinnati Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	8 10 a m	d 7 00 a m
	d 8 00 p m	5 40 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Zanesville, Gambier, Mt. Vernon and Columbus.	: 05 p m	12 50 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	8 10 a m	5 40 p m
	3 25 p m	9 35 a m

d Daily. Other trains except Sunday.

Pullman Palace Sleeping Cars daily between Cleveland, Columbus and Cincinnati. City ticket office, Weddell House corner.

—THE—

Cleveland & Marietta Ry.

THROUGH TRAINS

BETWEEN

Toledo, Cleveland and the Ohio River.

The shortest and best Route via Marietta to

Washington, D. C., Charleston, W. Va., Parkersburg, W. Va., and the South.

Direct connections at Union Depots, with all great through lines to all Points

WEST, NORTHWEST, SOUTH, SOUTHWEST AND SOUTHEAST.

Lowest Rates. Quickest Time. Best Accommodations.

Tickets sold and baggage checked through to destination. Reliable information and best rates will be furnished by any agent of the Popular C. M.

A. T. WIKOFF, Pres. and Gen. Mgr. W. K. RICHARDS, G. P. & T. A.

FT. WAYNE, CINCINNATI & LOUISVILLE RAILROAD.

The Popular Route Between the

NORTH and SOUTH

The Direct Route to or from

Fort Wayne, Indianapolis, Terre Haute, Evansville and St. Louis.

13 MILES SHORTER BETWEEN 13

Fort Wayne and Indianapolis,

Than any other Route.

22 MILES SHORTER AND QUICKER 22

BY THREE HOURS, BETWEEN

Louisville and Fort Wayne.

ASK FOR TICKETS VIA

Ft. Wayne, Cincinnati & Louisville R. R.

For sale by all Agents of connecting lines, East, West, North and South.

GEO. W. SAUL, Gen'l Supt. W. H. FISHER, Gen'l Pass. & Tk. Agt,

FORT WAYNE, IND.

PITTSBURGH AND LAKE ERIE RAILROAD.

"Cleveland & Pittsburgh Short Line."

Twenty (20) Miles Shorter than any other route between Cleveland, Pittsburgh, Washington, Baltimore and the South East.

5 Through Trains Daily 5

FAST TIME. NO DELAYS.

"For scenery picturesque and varied,
Through valleys green, 'mong mountains ser-
The people's favorite route I ween, [ried,
The P. & L. E. sits enthroned as queen."

See that your tickets read via

THE PEOPLE'S FAVORITE ROUTE.

E. HOLBROOK, Gen'l Supt., A. E. CLARK, G. P. & T. A.

Pittsburgh, Pa.

SCIOTO VALLEY RAILWAY.

Direct route, Columbus, O., to Circleville, Chillicothe, Waverly, Portsmouth, Ironton and Ashland, Ky. Three trains daily except Sunday. Favorite route, North and West, making close connection at Ashland, Ky., with the Chesapeake & Ohio Ry., through the canons of New River, passing White Sulphur Springs and the many Summer resorts of the Alleghenies in Virginia.

Shortest and Quickest Route to Richmond, Lynchburg, Newport News, Old Point Comfort.

J. ROBINSON, Receiver, Columbus, O. JNO. J. ARCHER, Gen'l Pass. Agt

THE MOSHER

Lifting Jack,

—IN—

NINE SIZES

Ranging in capacity from 6 to 20 Tons.

F. M. DE WEESE,

Manufacturer,

CHILICOTHE, Ohio.

For Sale.

—ONE—

Harlow Lubricator.

Brand new. Cheap. Address,

LUBRICATOR,

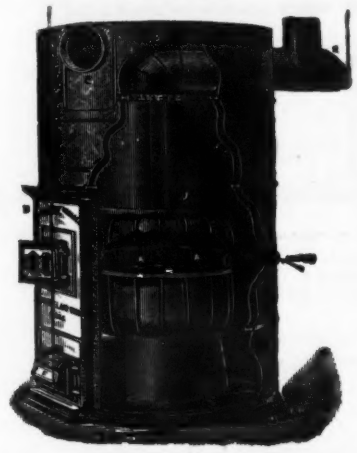
Care Iron Trade Review.

THE BEECHER FURNACE CO.,

MANUFACTURERS OF THE

Beecher Warm Air Furnace.

Burns Hard Coal, Soft Coal, Coke or Natural Gas.



ALSO

Heating and Ventilating Engineers

Estimates Furnished on Application.

Office, 116 Viaduct. Works, Elm St.,

CLEVELAND, OHIO.

Send for catalogue and discounts.

THE FAVORITE —AND— PICTURESQUE ROUTE —TO— New York, Boston and the East.

ERIE RAILWAY

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the South east.

New Central Depot So. Water St. and Viaduct

	Depart.
No. 62, Accommodation.....	† 6 05 a m
No. 72, New York Express.....	* 8 10 a m
No. 72, Fast Pittsburgh Express.....	* 8 10 a m
No. 64, Fast Pittsburgh Express.....	* 3 00 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 68, New York Vestibule Limited.	* 8 30 p m
No. 70, Pittsburgh Local Express.....	*11 25 a m
No. 74, Pittsburgh & Youngst'n Ex...	†11 00 p m
	Arrive.
No. 65, Fast New York Express.....	*10 15 a m
No. 61, N. Y. & Pittsburgh Express...	* 7 15 a m
No. 71, Leavittsburg Local.....	† 2 10 p m
No. 67, Pittsburgh Express.....	*12 45 p m
No. 63, New York Express.....	* 6 50 p m
No. 63, Pittsburgh Express.....	* 6 50 p m
No. 69, Pittsburgh Local Express.....	† 9 10 p m
No. 73, Mantua Accommo.....	* 7 20 p m
No. 75, Pittsburgh & Youngst'n Ex...	† 2 55 a m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.

A. M. TUCKER, Gen. Supt., Cleveland, O.

L. P. FARMER, Gen. Pass. Agt., New York

W. C. RINEARSON, Ass't G. P. A., Cleveland, O.

M. L. FOUTS, City Pass. and Ticket Agt., 141 Superior st., Weddell House, Cleveland, O.

Wheeling & Lake Erie Railway.

THE NEW THROUGH LINE

BETWEEN

TOLEDO

—AND—

Bowerston, Pittsburgh, Marietta.

THROUGH COACHES

BETWEEN

Toledo & Marietta.

Through Sleepers Between

PITTSBURGH AND CHICAGO.

AND DAY COACHES BETWEEN

Toledo and Pittsburgh, Via Akron, Cuyahoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.

The Only Line running through

"BEAUTIFUL ZOAR."

A. G. BLAIR, Traffic Manager. JAS. M. HALL, Gen'l Pass. Agent.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus st. Factories on Columbus, Winter and Leonard streets.

Cleveland, O., U. S. A

COMPOUND. CONDENSING OR NON-CONDENSING.
16 Sizes, 5 to 500 H. P. Not yet equaled by any form of Engine for HIGH FUEL DUTY AND SIMPLICITY.

STANDARD. 13 Sizes in Stock. 5 to 250 H. P.
3,000 in use in all parts of the Civilized World.

JUNIOR. 6 Sizes in Stock, 5 to 50 H. P.
AN AUTOMATIC ENGINE CHEAPER THAN A SLIDE VALVE.
Well Built. Economical. Reliable. Over 300 sold the first year.

All the above built strictly to Gauge with Interchangeable Parts. Repairs Carried in Stock. Send for Illustrated Catalogues.

WESTINGHOUSE ENGINES

The Westinghouse Machine Co.
PITTSBURGH, PA. U.S.A.

SELLING DEPARTMENT IN THE UNITED STATES.

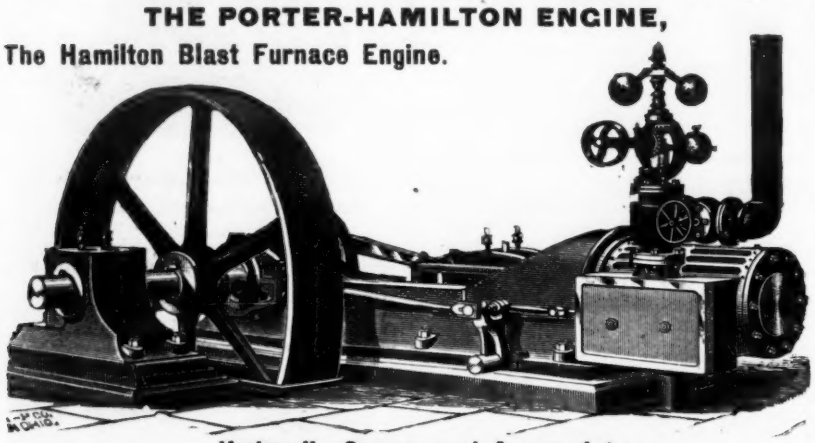
NEW YORK,	17 Cortlandt Street,	Westinghouse, Church, Kerr & Co.
BOSTON,	Hathaway Building,	
PITTSBURGH,	Westinghouse Building,	
CHICAGO,	156, 158 Lake Street,	
PHILADELPHIA,	608 Chestnut St., M. R. Muckle, Jr. & Co.	

ST. LOUIS,
511 NORTH FOURTH ST.,
WESTINGHOUSE, CHURCH, KERR & CO.

SALT LAKE CITY,	259 S. Main St.	Utah & Montana Machinery Co.
BUTTE, MONT.	E. Granite St.	
SAN FRANCISCO,	21 and 23 Fremont St.,	Parke & Lacy Co.
PORTLAND, OR.	33, 35 N. Front St.,	Parke & Lacy Mch. Co.
CHARLOTTE, N. C.	36 College St.,	The D. A. Tompkins Co.
ATLANTA, GA.	45 S. Prior St.	Keating Imp. & Mch. Co.
DALLAS, TEX.		
CHATTANOOGA, TENN.		C. E. James & Co.

WILLIAM TOD & CO., Youngstown, O.

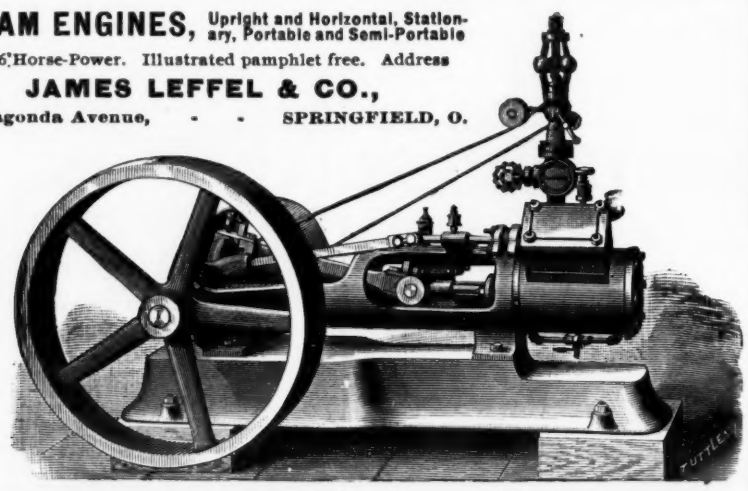
THE PORTER-HAMILTON ENGINE,
The Hamilton Blast Furnace Engine.



Hydraulic Cranes and Accumulators.
Heavy special machinery generally. Send for illustrated catalogue.

STEAM ENGINES,

Upright and Horizontal, Stationary, Portable and Semi-Portable
3 to 26 Horse-Power. Illustrated pamphlet free. Address
JAMES LEFFEL & CO.,
300 Lagonda Avenue, - - SPRINGFIELD, O.

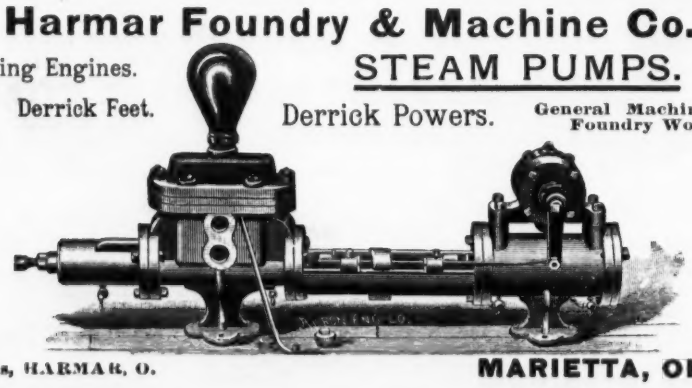


HEADQUARTERS
—FOR—
WOOD SPLIT PULLEYS.

A large stock of the
Milburn.
Best in the Market.
Engines and Boilers, Shafting and Hangers, Mill Supplies, Etc. Estimates given on Electric Light Plants.
THE GEO. WORTHINGTON CO.,
59 and 61 St. Clair Street,
CLEVELAND, O.

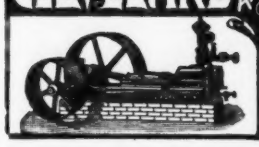
Harmar Foundry & Machine Co.

Hoisting Engines. Derrick Feet. STEAM PUMPS. Derrick Powers. General Machine and Foundry Work.



Works, HARMAR, O. MARIETTA, OHIO.

CLEVELAND AND HARDWICK ERIE ENGINE WORKS



MANUFACTURERS OF STEAM ENGINES AND BOILERS.
ERIE, PENN.

SKINNER ENGINE CO., ERIE, PA.

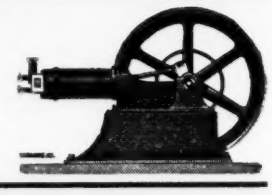
OVER 3400 IN USE.
Manufacturers of PORTABLE AND STATIONARY
ENGINES AND BOILERS
SEND FOR CATALOGUE.
NEW YORK and NEW ENGLAND OFFICE:
C. R. VINCENT & CO., 15 Cortlandt St., N. Y.

THE LAIDLAW & DUNN CO.

PUMPS OF EVERY DESCRIPTION. CINCINNATI, O. SEND FOR CIRCULAR.

Otto Gas Engine Works,

SCHLEICHER, SCHUMM & CO., Philadelphia. Chicago.
Horizontal OTTO Gas Engines.
Vertical OTTO Gas Engines.
Twin Cylinder OTTO Gas Engines.
Combined OTTO Gas Engine Pumps.
Combined OTTO Gas Engine Dynamos.
SIZES: 1. 2. 4. 7. 10. 15. 25 AND 50 HORSE-POWER.

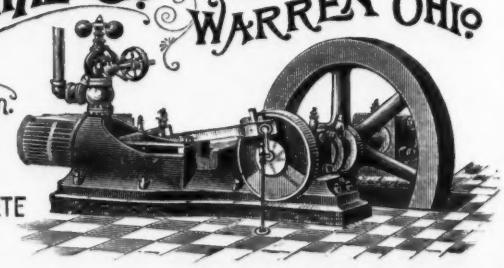


BOILERS

MAHONING BOILER WORKS.
PIPES, STACKS, BEAMS, ROOF TRUSSES, BLAST FURNACES, ROLLING MILL WORK.
WM. B. POLLOCK & CO. YOUNGSTOWN, O.

THE ÆTNA MEDIUM & HIGH SPEED ENGINE

Manufactured by THE ÆTNA MACHINE CO. WARREN OHIO.
150 to 2000 H.P. Latest Design.
FOR ROLLING MILLS AND ALL OTHER WORKS WHERE LARGE POWER AND CLOSE REGULATION IS REQUIRED
CONTRACTS MADE FOR COMPLETE STEAM PLANTS.
ENGINES ALWAYS IN STOCK.

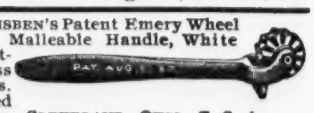


E. H. JONES & CO.,

223 and 225 River St., CLEVELAND, O.
ENGINEERS AND CONTRACTORS.

Steam Plants complete, including Pumps, Heaters, Engines, Boilers, etc

W. W. BRISBEN'S Patent Emery Wheel Dresser, Malleable Handle, White Hard Cutters, Brass Bearings. Warranted
Price $3.00. CLEVELAND, OHIO U. S. A.



VAN DUZEN GAS & GASOLINE ENGINE

OPERATED with COAL and OTHER MANUFACTURED GASES AND GASOLINE.
RELIABLE AND ECONOMICAL.
Fully Warranted
VAN DUZEN Gas & Gasoline Engine Co.
34 E. 2d St., Cincinnati, O.

IRON & STEEL ROOFING.

CORRUGATED & CRIMPED SIDING, CEILING ETC. MANUFACTURED BY W. G. HYNDMAN & CO. CINCINNATI =OHIO=

CORRUGATED IRON

Seven sizes of Corrugations---Straight or Curved. We want to mail you the Finest Roofing Catalogue ever published.

THOMPSON M'F'G CO., Cleveland, O.

The BERGER MANUFACTURING COMPANY, CANTON, O.

DON'T make arrangements for ROOFING until you have seen ours.

It Excels all other Metal Roofs.

THE AKRON BELTING CO.,

MANUFACTURERS OF

OAK-TANNED LEATHER BELTING

Also, ready for prompt shipment, Rubber and Cotton Belting, Wood Pulleys, No. 1 Raw Hide Lace Leather, and MILL SUPPLIES generally Address:

138 No. Main St., - - - AKRON, O.

CRIMPED

SYKES' IMPROVED Best Roof in the World. Suitable for all classes of buildings. Easy put on.

All my Iron and Steel is re-rolled and box annealed, well painted on both sides with the Best of Paint and Pure Linseed Oil.

CORRUGATED

SYKES IRON ROOFING CO., NILES, OHIO.

Send for Circular and Price List, and mention this paper.

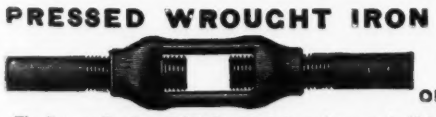
HOLTON IRON ROOFING CO.

ROOFING, SIDING, CEILING &C.

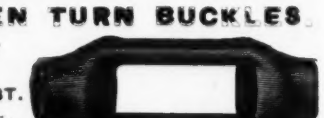
NEW LISBON, O.

AGENTS WANTED EVERYWHERE

PRESSED WROUGHT IRON OPEN TURN BUCKLES.



BEST AND CHEAPEST.



The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with Iron for tie rods.

CLEVELAND CITY FORGE & IRON CO., CLEVELAND, OHIO.

ENGINEERING SPECIALTIES

REDUCING VALVES · PUMP PRESSURE REGULATORS · OIL PUMPS, VALVES, ETC.

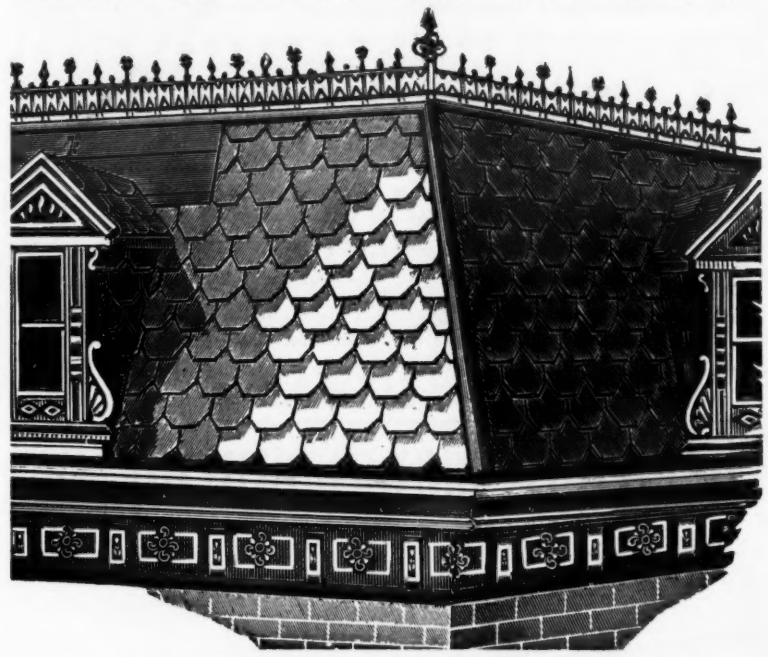
STANDARD REGULATOR CO. BUFFALO, N.Y.

SEND FOR CIRCULAR OF THE

"EASTLAKE"

Metallic Shingles and Siding!

THE BEST ROOFING FOR CHURCHES, SCHOOLS AND RESIDENCES.



MANUFACTURED BY W. J. BURTON & CO.,

—SUCCESSORS TO—

THE DETROIT METALLIC SHINGLE Co,. cor. State and Park Place, Detroit.

Soft Steel Plates and Sheets,

CORRUGATED ROOFING

Galvanized Iron. Patented Leveled Sheet.

THE STANDARD IRON COMPANY,

BRIDGEPORT, OHIO.

The Kanneberg Roofing Co., Canton, O.,

(The Originators of Strictly Genuine Steel Roofing.)

MANUFACTURERS OF

THE KANNEBERG PATENT LATEST IMPROVED FOLDED LOCK SEAM

Strictly Genuine Steel Roofing

WRITE FOR CATALOGUE, PRICE

CORRUGATED IRON-

(Four Sizes of Corrugations.)

Crimped Edge Iron Roofing and Siding, Beaded Iron Siding and Ceiling, Water Proof Building Paper, Ready-Mixed Paints, Etc.

LIST AND SAMPLES.

GARRY IRON ROOFING COMPANY,

The Largest Manufacturers of Iron Roofing in the World,

MANUFACTURERS OF ALL KINDS OF

Iron Roofing, Crimped and Corrugated Siding, Iron Tile or Shingle, Fire-Proof Doors and Shutters, Iron Ore Paint and Cement.

Iron Frames for Roofs and Buildings.

No. 152 MERWIN ST., CLEVELAND, OHIO.

Send for circulars and price list No. A

CAMBRIDGE ROOFING CO., Cambridge, O..

Manufacturers of

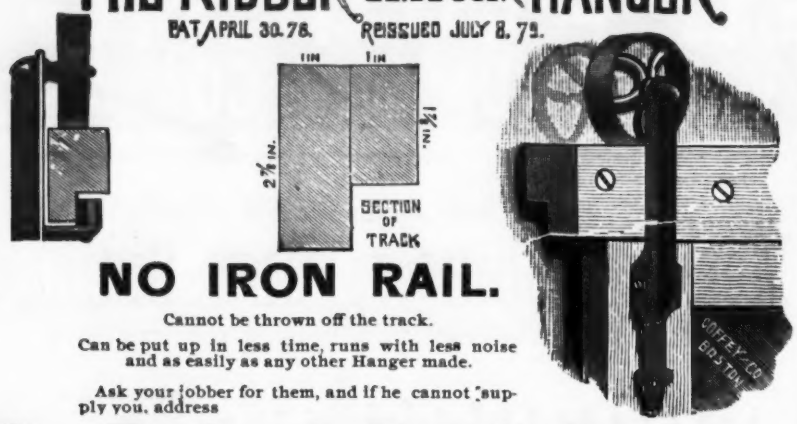
Plain, Rolled, Crimped Edge, Corrugated and Beaded Roofing, Siding and Ceiling.

PURE STEEL A SPECIALTY.

Send for Descriptive Catalogue.

THE KIDDER SLIDE DOOR HANGER

PAT. APRIL 30, 78. REISSUED JULY 8, 79.



NO IRON RAIL.

Cannot be thrown off the track.

Can be put up in less time, runs with less noise and as easily as any other Hanger made.

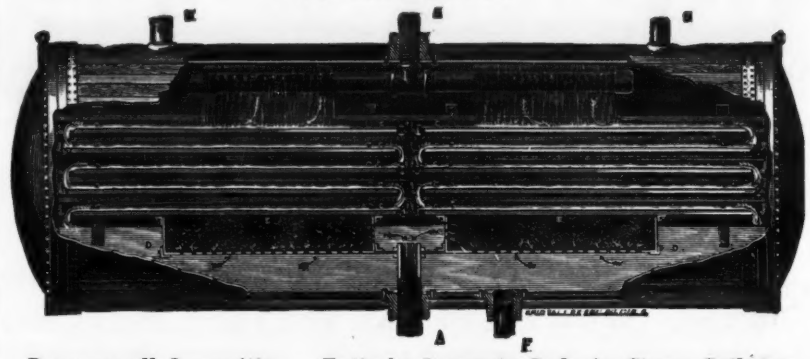
Ask your jobber for them, and if he cannot supply you, address

The Taylor & Boggis Fdy. Co.,

CLEVELAND, OHIO.

STILWELL'S PATENT LIVE STEAM-FEED WATER PURIFIER.

(HORIZONTAL STYLE.)



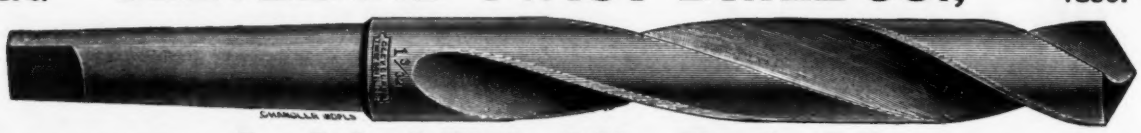
Removes all Impurities. Entirely Prevents Scale in Steam Boilers.

CATALOGUE ON APPLICATION.

STILWELL & BIERCE MANUFACTURING CO.

DAYTON, OHIO.

OLD 1874. **CLEVELAND TWIST DRILL CO.,** RELIABLE 1890.



SEND FOR CATALOGUE. **Cor. Lake & Kirtland Sts., Cleveland, O.** WRITE FOR DISCOUNTS.

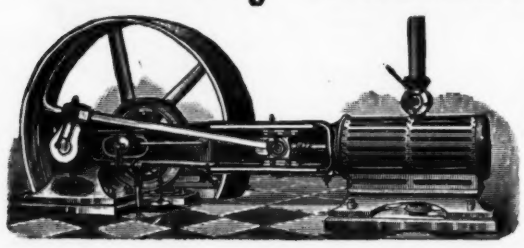
A NEW INVENTION.

SURE GRIP STEEL TACKLE BLOCK

HALF THE COST of hoisting saved to machinists, builders, contractors, butchers and others. Admitted to be the greatest improvement ever made in tackle blocks. The cheapest in the market. Sent on trial. Write for catalogue.

Fulton Iron & Engine Works,
17 Brush St., Detroit, Mich.
Established 1852.

The Kilby Manufacturing Co.,



CLEVELAND, O.

Recent extensive additions to our Shops and Machinery makes our Plant one of the largest and best equipped in the country.

We are now prepared and have facilities for doing Foundry and Machinist work of every description. Shall be glad to furnish estimates on application for Engines, Boilers and other heavy machinery.

C. H. COLLINGS. C. H. PRITCHARD.

THE

CONGER & COLLINGS MANTEL CO.

Wood Mantels, Tiles and Grates,

GAS FIXTURES AND ELECTROLIERS,

WROUGHT IRON SPECIALTIES.

217 to 223 Euclid Avenue, CLEVELAND, O.

Gray Planers

24″, 26″, 32″, 36″, 42″ and 56″.

Any length of bed. Address

Parkin & Bosworth,

CLEVELAND, OHIO.

REYNOLDS BROS.,

MANUFACTURERS OF

Hand Cut Files

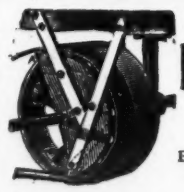
AND RASPS.

We solicit the commercial trade only.

133 & 135 N. Water St.,

COLUMBUS, OHIO.

Old Files Recut and Warranted Superior to any Machine Cut and Lead Tempered in the market. Send for price list



WELLINGTON

Belt Holder.

Recent Improved.

BETTER THAN LOOSE PULLEYS.

Shifts Belt from Driving Pulley.

Belt stops when machine stops and lies slack until machine starts. Simple, cheap, easily operated. Sent on approval. Thousands in use. Address

W. R. SANTLEY & CO.,

Wellington, O.

ECLIPSE ELECTROTYPE AND ENGRAVING CO.

AUST & CLARK PROPRIETORS

LITHOGRAPH BUILDING CLEVELAND

The Hart or Detroit

Emery-Corundum

WHEELS AND MACHINERY.

WRITE TO

J. WENDELL COLE, M. E.,

BOX 152, CHICAGO, ILL., or BOX 84 COLUMBUS, O.

THE WILMOT & HOBBS MFG. CO.,

BRIDGEPORT, CONN.

MANUFACTURERS OF

COLD ROLLED STRIP STEEL

SMOOTH SURFACE AND EVEN GAUGE.

ALSO

Plain and Lock Seamed

STEEL, BRASS and COPPER TUBING to ORDER.

Cold Rolled Strip Steel furnished in long coils or cut to lengths and sheared to exact widths when desired, in tempers adapted to requirements. Also C. R. Spring Steel.

Please mention this paper.

HOMOG-ENEOUS TRADE "NEVER BREAK." STEEL MARK SPIDER

The Bronson Supply Co.,

CLEVELAND, O., U. S. A.

Exclusive Manufacturers

Nos. 7, 8, 9, 10 and 12.

Will not absorb Grease; will not impart the Flavor of previously Cooked Food; Easily kept clean.

BETTER THAN ENAMEL,

Because They Will Not Scale.

USE THE BEST.

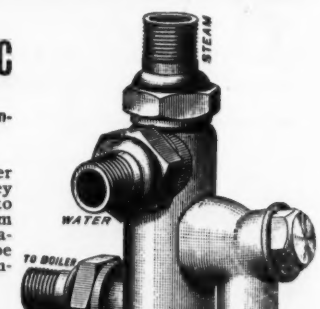
The PENBERTHY IMPROVED AUTOMATIC INJECTOR.

A Thoroughly Reliable and Simple Boiler Feeder for Stationary, Marine and Portable Boilers.

POINTS TO BE CONSIDERED.

They have only two VALVES to operate, only one after water valve is adjusted. They require no watching, as they RESTART AUTOMATICALLY if feed is broken. They lift 18 to 20 feet, and hot pipes don't affect them. They work from 25 to 135 and 160 lbs. pressure on water at natural temperature. The working parts are interchangeable and can be taken from Injector without any tools or breaking connections.

Send for circular, price list and discount.



PENBERTHY INJECTOR CO.

DETROIT, MICH.

C. H. PRESLEY & CO., Agents, Cleveland, O.